PATENT ABSTRACTS OF JAPAN

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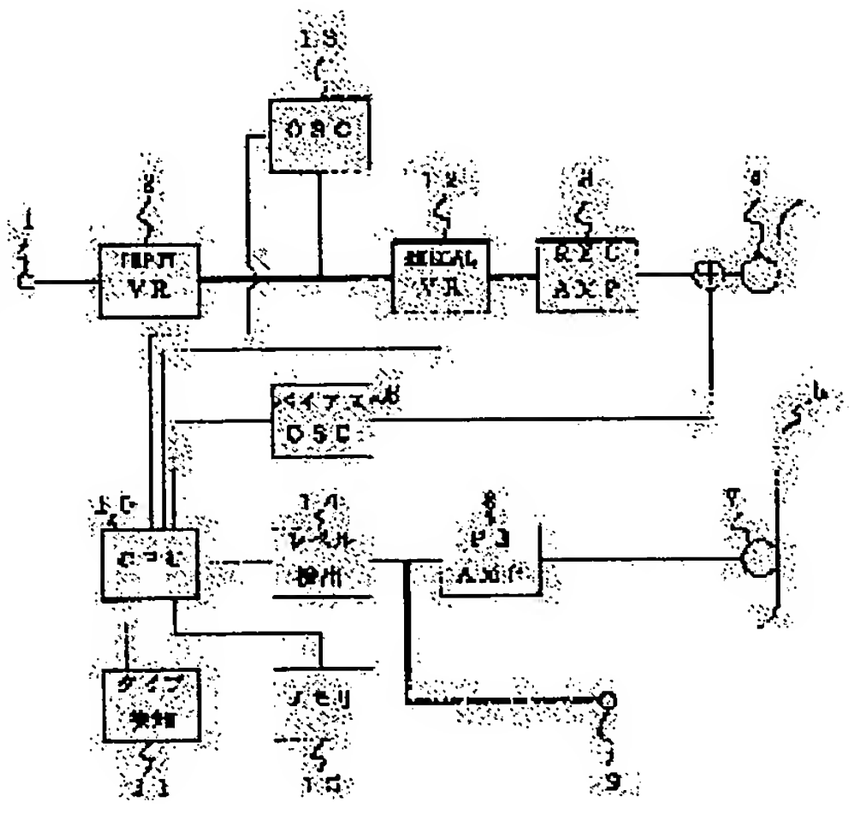
(54) RECORDER

(57)Abstract:
PROBLEM TO BE SOLVED: To determine the peak sound recording level corresponding to the characteristic of the recording medium of a tape to be used or the like.
SOLUTION: A MOL (an output level in which a third harminic distortion becomes 3% in the case of performing a recording with a prescribed bias current) or the deviation of the MOL is calculated from the sensitivity of a tape 5 by utilizing the correlation between the sensitivity of the tape 5 and the MOL and a peak sound recording level is determined from the MOL or the deviation of the MOL. Moreover, the input level when an input-output level difference is zero, is calculated from a measured input-output level by utilizing the correlation between the input level and the input-output level difference. Further, the peak sound recording level is determined by considering the frequency characteristic of a musical signal.



* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1]Have the following and it asks for a deviation of MOL of said recording medium, or MOL based on a relation which recording sensitivity and said memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, A recording head determining a peak recording level based on a deviation of this MOL or MOL and which records a signal to a recording medium, and a recorder which has a playback head which plays a signal from a recording medium.
A test signal generating means which generates a test signal.
A memory measure which has memorized a relation of MOL to recording sensitivity of a recording medium.
A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium.

[Claim 2]Recording sensitivity of a recording medium which was provided with the following and said recording sensitivity measuring means measured, It asks for a deviation of MOL of said recording medium, or MOL based on a relation which said proper bias and said 1st and 2nd memory measure have memorized, A recording head determining a peak recording level based on a deviation of this MOL or MOL and which records a signal to a recording medium, and a recorder which has a playback head which plays a signal from a recording medium.
A test signal generating means which generates a test signal.
The 1st memory measure that has memorized a relation of MOL to recording sensitivity of a recording medium.
A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium.
A bias determination means to determine proper bias which is bias suitable for said recording medium, and the 2nd memory measure that memorizes a relation of MOL to bias.

[Claim 3]Based on a relation which a level difference which was provided with the following and said level difference measuring means measured, and said memory measure have memorized, A recording head which asks for an input level corresponding to a predetermined input output level difference of said recording medium, and is characterized by determining a peak recording level based on this input level and which records a signal to a recording medium, and a recorder which has a playback head which plays a signal from a recording medium.
A test signal generating means which generates a test signal.
A memory measure which has memorized beforehand a relation of an input level to an input output level difference.
A level difference measuring means which measures an input output level difference by recording and playing said test signal to said recording medium.

[Claim 4]Have the following and it asks for a deviation of MOL of a recording medium, or MOL based on a relation which recording sensitivity and said 1st memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, The 1st recording level determined based on a deviation of this MOL or MOL, Based on a relation which a level difference which said level difference measuring means measured, and said 2nd memory measure have memorized, It asks for an input level corresponding to a predetermined input output level difference of a recording medium to be used, Said

comparison means compares the 2nd recording level determined based on this input level, A recording head determining a low value as a peak recording level among the 1st and 2nd recording level and which records a signal to a recording medium, and a recorder which has a playback head which plays a signal from a recording medium.
A test signal generating means which generates a test signal.
The 1st memory measure that has memorized beforehand a relation of MOL to recording sensitivity of a recording medium.
The 2nd memory measure that has memorized beforehand a relation of an input level to an input output level difference.
A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, a level difference measuring means which measures an input output level difference by recording and playing said test signal to said recording medium, and a comparison means to compare size of a recording level.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[0001]
[0002]
[Industrial Application]It is related with the recorder which determines a peak recording level automatically.
[0003]
[0002]
[0004]
[Description of the Prior Art]It is known by a tape type that tape characteristics, such as tape sensitivity, differ, the tape type of the tape to be used was detected, and there was a device which determines the peak recording level beforehand decided according to the tape type.
[0005]
[0003]
[0006]
[Problem(s) to be Solved by the Invention]However, if the maker or brand manufactured even when a tape type is the same is different, tape characteristics differ, and in setting out of the peak recording level only by a tape type, setting out of the optimal peak recording level cannot be performed.
[0007]Then, this invention measures the characteristic of the recording medium to be used, and it is setting up the peak recording level according to the measurement data, and aims at attaining good sound recording.
[0008]
[0004]
[0009]
[Means for Solving the Problem]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 1 records a signal to a recording medium, A test signal generating means which generates a test signal, and a memory measure which has memorized a relation of MOL to recording sensitivity of a recording medium, It has a recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, It asks for a deviation of MOL of said recording medium, or MOL based on a relation which recording sensitivity and said memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, and a peak recording level is determined based on a deviation of this MOL or MOL.
[0010]
[0005]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 2 records a signal to a recording medium, A test signal generating means which generates a test signal, and the 1st memory measure that has memorized a relation of MOL to recording sensitivity of a recording medium, A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, A bias determination means to determine proper bias which is bias suitable for said recording medium, It has the 2nd memory measure that memorizes a relation of MOL to bias, It asks for a deviation of MOL of said recording medium, or MOL based on a relation which recording sensitivity, said proper bias, and said 1st and 2nd memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, and a peak recording level is determined based on a deviation of this MOL or MOL.

[0011]
[0006]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 3 records a signal to a recording medium, A test signal generating means which generates a test signal, and a memory measure which has memorized beforehand a relation of an input level to an input output level difference, It has a level difference measuring means which measures an input output level difference by recording and playing said test signal to said recording medium, It asks for an input level corresponding to a predetermined input output level difference of said recording medium based on a relation which a level difference which said level difference measuring means measured, and said memory measure have memorized, and a peak recording level is determined based on this input level.
[0012]
[0007]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 4 records a signal to a recording medium, A test signal generating means which generates a test signal, and the 1st memory measure that has memorized beforehand a relation of MOL to recording sensitivity of a recording medium, The 2nd memory measure that has memorized beforehand a relation of an input level to an input output level difference, A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, A level difference measuring means which measures an input output level difference by recording and playing said test signal to said recording medium, Have a comparison means to compare size of a recording level, and it asks for a deviation of MOL of a recording medium, or MOL based on a relation which recording sensitivity and said 1st memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, The 1st recording level determined based on a deviation of this MOL or MOL, Ask for an input level corresponding to a predetermined input output level difference of a recording medium to be used based on a relation which a level difference which said level difference measuring means measured, and said 2nd memory measure have memorized, and said comparison means compares the 2nd recording level determined based on this input level, and The 1st, A low value is determined as a peak recording level among the 2nd recording level.
[0013]
[0008]
[0014]
[Example]Hereafter, the details of an embodiment of the invention are explained based on a drawing.
[0015]
[0009][A 1st embodiment] Let 3% of 3rd harmonic distortion be a rule of thumb as a distortion amount generally permitted on audibility. So, in a 1st embodiment, a peak recording level decision is made based on the deviation of MOL (output level from which the 3rd harmonic distortion will be 3% when it records by predetermined bias current), or MOL.
[0016]
[0010]The characteristic of MOL to the tape sensitivity (difference of the output level to an input level) which is the recording sensitivity of a recording medium in a predetermined test signal was measured using various chromium type tapes in which a maker differs from a brand. MOL is as high as a tape with a high output level, and the tendency for MOL to be low is known with this result to sufficient namely, tape sensitivity by the tape with conversely worse tape sensitivity. Thus, there is correlation in tape sensitivity and MOL. The MOL characteristic to tape sensitivity shows the same characteristic also by Normal other than a chromium type, and a metal type.
[0017]
[0011]In this embodiment, this correlation is used, it asks for the deviation of MOL or MOL from tape sensitivity, and a peak recording level is determined from the deviation of this MOL or MOL. In this embodiment, since proportionality is mostly looked at by the correlation of tape sensitivity and MOL, both correlation is approximated to proportionality and performed. The characteristic figure (chromium type) is shown in drawing 1. However, since the MOL characteristics to tape sensitivity differ with every tape type, it is necessary to use the inclination etc. which were doubled with the tape type.
[0018]
[0012]Drawing 2 is circuitry of a 1st embodiment.
[0019]The signal inputted from the input terminal 1 via the sound recording calibration volume 12 which adjusts the signal level by the input volume 2 which changes a signal level, and tape sensitivity, After the

sound recording amplifier 3 is supplied and being amplified with this sound recording amplifier 3, it is recorded by the recording head 4 by the tape 5 which is a recording medium. The test signal by the test signal oscillator 13 which oscillates a test signal is similarly recorded via the sound recording calibration volume 12 and the sound recording amplifier 3. The playback head 7 is reproduced, and the signal recorded by the tape 5 is amplified by the playback amplifier 8, and is outputted to the output terminal 9. The output level of the tape which was played by the playback head 7 and amplified with the playback amplifier 8 is detected in the level detection circuit 14, and is incorporated into central processing unit CPU10. CPU10 determines the level of suitable bias and the sound recording calibration volume 12 with the data detected by the output level of a test signal, the frequency, and the level detection circuit 14 which the test signal generator 13 generates. CPU10 determines the optimal peak recording level based on these decision results.

[0020]

[0013]Concrete operation is explained using drawing 2 and drawing 3. The tape type of the tape which is a recording medium is detected by the type detection means 11 (Step 1).

[0021]

[0014]CPU10 carries out temporary setting of the peak recording level initial value based on the table 1 (drawing 4) memorized by the detected tape type and the memory 15 (Step 2). This peak recording level initial value is determined as the level which can perform good sound recording by measurement and an audition of MOL of the tape (tape sensitivity is 0) of the standard characteristic, S/N, etc. For example, by a chromium type, temporary setting is carried out to -4.0dBV. Since it is measured using the bias of a standard (REF), this value needs to amend, when bias amounts differ. This amendment is performed at the below-mentioned step 6.

[0022]

[0015]Next, adjustment of bias is performed so that the sound recording reproduction frequency characteristic of a tape may become a flat. The test signal oscillator 13 bias adjustment 400 Hz, -23dBV, and 10 kHz, -Output the test signal of 23dBV, change bias to the three-stage of OVER (deep compared with a standard), REF (standard), and UNDER (shallow compared with a standard) with the bias oscillator 6, and record each test signal. And both test signals are reproduced by the playback head 7, bias amounts when the output level of both test signals shows the nearest value are chosen as rated bias, and the bias oscillator 6 is set as these bias amounts. (Step 3).

[0023]

[0016]Next, sound recording sensitivity is adjusted so that the difference of the input level to a tape and an output level may be set to 0. While the test signal oscillator 13 outputs the test signal of 400 Hz and -23dBV and carries out the sweep of the volume of the sound recording calibration volume 12, it records on the tape 5. Then, a sweep signal is played from the tape 5. At the time of this playback, CPU10 compares the output level of the test signal generator 13 with the data detected by the level detection circuit 14, and it sets up the sound recording calibration volume 12 so that a difference may be set to 0 (Step 4).

[0024]

[0017]Next, tape sensitivity is measured. The initial volume position before adjustment of the sound recording calibration volume 12 in Step 4, Since the difference of an input level and an output level is a position used as 0 in the tape of the standard characteristic mentioned above and the amount of adjustments of the sound recording calibration volume 12 in Step 4 is the tape sensitivity itself, The amount of adjustments of the sound recording calibration volume 12 of Step 4 is memorized in the memory 15. (Step 5).

[0025]

[0018]Next, the bias selected at Step 3 performs peak recording level setting out. CPU10 amends the bias determined at Step 3 based on the table 2 (drawing 5) of peak recording level correction value to the bias memorized by the memory 15. For example, when bias is chosen as UNDER, It is amended by -4.7dBV which is the value lowered 0.7 dB from recording level initial value-4.0dBV by which temporary setting is carried out in order that MOL may show a value (deviation of MOL to the bias REF) low 0.7 dB compared with the time of bias being REF (Step 6).

[0026]

[0019]Next, MOL is amended from the tape sensitivity measured at Step 5, and peak recording level setting out is performed. For example, inclination 0.7 (chromium type) of the tape sensitivity pair MOL characteristic currently held as the table 3 (drawing 6) at the memory 15 as tape sensitivity is +1.3 dB is used, +calculating with 1.3x0.7=0.9dB (deviation of MOL to the tape sensitivity 0) -- MOL -- +-- it turns out that it is high 0.9

dB. Therefore, a peak recording level is determined as −4.7dBV+0.9−dB=−3.8dBV (Step 7).
[0027]
[0020]Although MOL was calculated from tape sensitivity and the adjusted bias in a 1st embodiment, MOL may be calculated only with tape sensitivity in the fixed bias recorder which does not adjust bias. Although tape sensitivity and the relation of MOL were approximated according to proportionality (primary function) and performed in a 1st embodiment, tape sensitivity and the relation of MOL may approximate with two or more function etc.
[0028]
[0021]Although MOL was calculated by the operation using the coefficient for an operation memorized by the memory in a 1st embodiment, the table showing the relation of MOL to much tape sensitivity is memorized in the memory, and MOL may be calculated using this table. Although it asked for the bias of a standard, and the deviation of MOL by tape sensitivity, the peak recording level initial value was amended and the peak recording level was determined in a 1st embodiment, MOL may be calculated from the table in the measured tape sensitivity, use bias, and a memory, only a predetermined value may make a level go up and down from the MOL, and a peak recording level may be determined based on MOL.
[0029]
[0022][A 2nd embodiment] The input−output behavioral characteristics of high signalling frequency determine a peak recording level. In high predetermined signalling frequency, for example, a 10−kHz signal, if the characteristic of an input output level difference to an input level is measured, the tendency for an input output level difference to become large will be seen as an input level becomes high. The input output level difference said here is a level difference which lengthened the output level which is a signal level which played the signal from the tape from the input level which is a level of the signal recorded on the tape. Thus, there is correlation in an input level and an input output level difference. Since this input output level difference appears notably in high signalling frequency, if an input output level difference is 0 in high signalling frequency, the input output level difference in frequency lower than it is 0. And if this input output level difference is 0, it can be said that sound recording faithful to the HARASHIN item is possible, and it is good sound recording.
[0030]
[0023]Therefore, it asks for the input level at the time of being the input output level difference 0 from the measured input output level difference based on the characteristic of an input output level difference to this input level. A peak recording level can be determined by furthermore taking the frequency characteristic of a music signal into consideration. In this embodiment, since proportionality is mostly looked at by the correlation of an input level and an input output level difference, both correlation is approximated to proportionality. The characteristic figure in a chromium type is shown in drawing 7. If it is the same tape type, even if bias will change, the almost same inclination is shown. However, although not illustrated, tape types other than a chromium type also show proportionality mostly, but a chromium type differs from inclination.
[0031]
[0024]Concrete operation is explained using drawing 2 and drawing 8. The tape type of the tape recorded by the type detection means 11 is detected (Step 11). For example, suppose that the chromium type was detected.
[0032]
[0025]CPU10 controls to output the test signal of 10 kHz and −6dBV with the test signal oscillator 13. A test signal is recorded and played by the tape 5, and CPU10 detects the input output level difference of a test signal with the regeneration level which the level detection circuit 14 detected (Step 12).
[0033]
[0026]Next, an input output level difference calculates the input level used as 0 from the input output level difference which CPU10 detected. The inclination of the input output level difference characteristic to the input level according to a tape type is memorized on the table 4 (drawing 9) in the memory 15. Here, since the tape type is detected with the chromium type at Step 11, it inclines and −1.6 is used for the operation of an input level. For example, supposing the input output level difference detected at Step 12 is −3dB, in order to set an input output level difference to 0, it is necessary to contract this difference of only 3 dB for Masakata. So, if 3 dB is multiplied by inclination−1.6 of the chromium type characteristic, in order to be set to 3dBx−1.6=−4.8dB and to set an input output level difference to 0, it is necessary to use an input level of only 4.8 dB [level / (−6dBV) / of a test signal] as a low level. That is, if an input level is less than −6dBV−4.8dB=−10.8dBV, it will be thought that the input level difference is 0. However, if frequency analysis of a music signal

is conducted, also in the music signal which includes the high-frequency component most, a 10-kHz level of not less than 7.5 dB used as a test signal is low compared with the level of all the zones. For this reason, as a peak recording level, it is decided that it will be -10.8dBV+7.5-dB=-3.3dBV (Step 13).

[0034]

[0027]Although it asked for the input level in the input output level difference 0 by the operation using the coefficient for an operation memorized by the memory in a 2nd embodiment, The table showing the relation of the input level to many input output level differences is memorized in the memory, and it may ask for an input level in case an input output level difference is 0 using this table. Although the input level and the relation of the input output level difference were approximated according to proportionality (primary function) and performed in a 2nd embodiment, tape sensitivity and the relation of MOL may approximate with two or more function etc.

[0035]

[0028][A 3rd embodiment] This embodiment determines a still higher-precision peak recording level using both of the peak recording level determination by the frequency characteristic of the high frequency signal shown in the peak recording level determination and a 2nd embodiment by the sensitivity shown in a 1st embodiment.

[0036]

[0029]Concrete operation is explained using drawing 10. First, Step 7 is performed from Step 1 of a 1st embodiment. The 1st peak recording level determined at Step 7 is held in the memory 15 (Step 31). The 1st peak recording level is -3.8dBV in the example currently given here.

[0037]

[0030]Next, Step 13 is performed from Step 11 of a 2nd embodiment, the 2nd peak recording level is determined, and it memorizes in the memory 15 (Step 32). The 2nd peak recording level is -3.3dBV in the example currently given here.

[0038]

[0031]Next, CPU10 compares 1st and 2nd peak recording level both, and it chooses a low value. Here, -3.8dBV which is the 1st peak recording level is chosen. If it records on a bigger level than the 1st peak recording level, distortion will become large, the reason for choosing both lower one poses an audibility top problem, and when it is recorded with a bigger value than the 2nd peak recording level, it is because it becomes the sound recording with which it was filled, without obtaining an output level to an input level. And the value selected here is determined as an optimal peak recording level (Step 33).

[0039]

[0032]The detection operation of the tape type performed at Step 32 may be omitted, and may use the tape type detection result of Step 31.

[0040]

[0033]Step 4 and Step 12 which detect tape characteristics by a test signal may be performed continuously.

[0041]

[0034]

[0042]

[Effect of the Invention]Thus, since record and playback of a test signal are performed and a peak recording level is determined from the characteristic of recording media, such as tape sensitivity, the peak recording level which fully used the capability of the recording medium to be used can be determined.

[Translation done.]

* NOTICES *

TECHNICAL FIELD

[Industrial Application]It is related with the recorder which determines a peak recording level automatically.
[0003]
[0002]

[Translation done.]

* NOTICES *

PRIOR ART

[Description of the Prior Art]It is known by a tape type that tape characteristics, such as tape sensitivity, differ, the tape type of the tape to be used was detected, and there was a device which determines the peak recording level beforehand decided according to the tape type.
[0005]
[0003]

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EFFECT OF THE INVENTION

[Effect of the Invention]Thus, since record and playback of a test signal are performed and a peak recording level is determined from the characteristic of recording media, such as tape sensitivity, the peak recording level which fully used the capability of the recording medium to be used can be determined.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, if the maker or brand manufactured even when a tape type is the same is different, tape characteristics differ, and in setting out of the peak recording level only by a tape type, setting out of the optimal peak recording level cannot be performed.
[0007]Then, this invention measures the characteristic of the recording medium to be used, and it is setting up the peak recording level according to the measurement data, and aims at attaining good sound recording.
[0008]
[0004]

[Translation done.]

* NOTICES *

MEANS

[Means for Solving the Problem]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 1 records a signal to a recording medium, A test signal generating means which generates a test signal, and a memory measure which has memorized a relation of MOL to recording sensitivity of a recording medium, It has a recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, It asks for a deviation of MOL of said recording medium, or MOL based on a relation which recording sensitivity and said memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, and a peak recording level is determined based on a deviation of this MOL or MOL.

[0010]

[0005]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 2 records a signal to a recording medium, A test signal generating means which generates a test signal, and the 1st memory measure that has memorized a relation of MOL to recording sensitivity of a recording medium, A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, A bias determination means to determine proper bias which is bias suitable for said recording medium, It has the 2nd memory measure that memorizes a relation of MOL to bias, It asks for a deviation of MOL of said recording medium, or MOL based on a relation which recording sensitivity, said proper bias, and said 1st and 2nd memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, and a peak recording level is determined based on a deviation of this MOL or MOL.

[0011]

[0006]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 3 records a signal to a recording medium, A test signal generating means which generates a test signal, and a memory measure which has memorized beforehand a relation of an input level to an input output level difference, It has a level difference measuring means which measures an input output level difference by recording and playing said test signal to said recording medium, It asks for an input level corresponding to a predetermined input output level difference of said recording medium based on a relation which a level difference which said level difference measuring means measured, and said memory measure have memorized, and a peak recording level is determined based on this input level.

[0012]

[0007]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 4 records a signal to a recording medium, A test signal generating means which generates a test signal, and the 1st memory measure that has memorized beforehand a relation of MOL to recording sensitivity of a recording medium, The 2nd memory measure that has memorized beforehand a relation of an input level to an input output level difference, A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, A level difference measuring means which measures an input output level difference by recording and playing said test signal to said recording medium, Have a comparison means to compare size of a recording level, and it asks for a deviation of MOL of a recording medium, or MOL based on a relation which recording sensitivity and said 1st memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, The 1st recording level determined based on a deviation of this MOL or MOL, Ask for an input level corresponding to a predetermined input output level

difference of a recording medium to be used based on a relation which a level difference which said level difference measuring means measured, and said 2nd memory measure have memorized, and said comparison means compares the 2nd recording level determined based on this input level, and The 1st, A low value is determined as a peak recording level among the 2nd recording level.
[0013]
[0008]

[Translation done.]

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EXAMPLE

[Example]Hereafter, the details of an embodiment of the invention are explained based on a drawing.
[0015]
[0009][A 1st embodiment] Let 3% of 3rd harmonic distortion be a rule of thumb as a distortion amount generally permitted on audibility. So, in a 1st embodiment, a peak recording level decision is made based on the deviation of MOL (output level from which the 3rd harmonic distortion will be 3% when it records by predetermined bias current), or MOL.
[0016]
[0010]The characteristic of MOL to the tape sensitivity (difference of the output level to an input level) which is the recording sensitivity of a recording medium in a predetermined test signal was measured using various chromium type tapes in which a maker differs from a brand. MOL is as high as a tape with a high output level, and the tendency for MOL to be low is known with this result to sufficient namely, tape sensitivity by the tape with conversely worse tape sensitivity. Thus, there is correlation in tape sensitivity and MOL. The MOL characteristic to tape sensitivity shows the same characteristic also by Normal other than a chromium type, and a metal type.
[0017]
[0011]In this embodiment, this correlation is used, it asks for the deviation of MOL or MOL from tape sensitivity, and a peak recording level is determined from the deviation of this MOL or MOL. In this embodiment, since proportionality is mostly looked at by the correlation of tape sensitivity and MOL, both correlation is approximated to proportionality and performed. The characteristic figure (chromium type) is shown in drawing 1. However, since the MOL characteristics to tape sensitivity differ with every tape type, it is necessary to use the inclination etc. which were doubled with the tape type.
[0018]
[0012]Drawing 2 is circuitry of a 1st embodiment.
[0019]The signal inputted from the input terminal 1 via the sound recording calibration volume 12 which adjusts the signal level by the input volume 2 which changes a signal level, and tape sensitivity, After the sound recording amplifier 3 is supplied and being amplified with this sound recording amplifier 3, it is recorded by the recording head 4 by the tape 5 which is a recording medium. The test signal by the test signal oscillator 13 which oscillates a test signal is similarly recorded via the sound recording calibration volume 12 and the sound recording amplifier 3. The playback head 7 is reproduced, and the signal recorded by the tape 5 is amplified by the playback amplifier 8, and is outputted to the output terminal 9. The output level of the tape which was played by the playback head 7 and amplified with the playback amplifier 8 is detected in the level detection circuit 14, and is incorporated into central processing unit CPU10. CPU10 determines the level of suitable bias and the sound recording calibration volume 12 with the data detected by the output level of a test signal, the frequency, and the level detection circuit 14 which the test signal generator 13 generates. CPU10 determines the optimal peak recording level based on these decision results.
[0020]
[0013]Concrete operation is explained using drawing 2 and drawing 3. The tape type of the tape which is a recording medium is detected by the type detection means 11 (Step 1).
[0021]
[0014]CPU10 carries out temporary setting of the peak recording level initial value based on the table 1 (drawing 4) memorized by the detected tape type and the memory 15 (Step 2). This peak recording level initial value is determined as the level which can perform good sound recording by measurement and an audition of

MOL of the tape (tape sensitivity is 0) of the standard characteristic; S/N, etc. For example, by a chromium type, temporary setting is carried out to -4.0dBV. Since it is measured using the bias of a standard (REF), this value needs to amend, when bias amounts differ. This amendment is performed at the below-mentioned step 6.

[0022]

[0015]Next, adjustment of bias is performed so that the sound recording reproduction frequency characteristic of a tape may become a flat. The test signal oscillator 13 bias adjustment 400 Hz, -23dBV, and 10 kHz, -Output the test signal of 23dBV, change bias to the three-stage of OVER (deep compared with a standard), REF (standard), and UNDER (shallow compared with a standard) with the bias oscillator 6, and record each test signal. And both test signals are reproduced by the playback head 7, bias amounts when the output level of both test signals shows the nearest value are chosen as rated bias, and the bias oscillator 6 is set as these bias amounts. (Step 3).

[0023]

[0016]Next, sound recording sensitivity is adjusted so that the difference of the input level to a tape and an output level may be set to 0. While the test signal oscillator 13 outputs the test signal of 400 Hz and -23dBV and carries out the sweep of the volume of the sound recording calibration volume 12, it records on the tape 5. Then, a sweep signal is played from the tape 5. At the time of this playback, CPU10 compares the output level of the test signal generator 13 with the data detected by the level detection circuit 14, and it sets up the sound recording calibration volume 12 so that a difference may be set to 0 (Step 4).

[0024]

[0017]Next, tape sensitivity is measured. The initial volume position before adjustment of the sound recording calibration volume 12 in Step 4, Since the difference of an input level and an output level is a position used as 0 in the tape of the standard characteristic mentioned above and the amount of adjustments of the sound recording calibration volume 12 in Step 4 is the tape sensitivity itself, The amount of adjustments of the sound recording calibration volume 12 of Step 4 is memorized in the memory 15. (Step 5).

[0025]

[0018]Next, the bias selected at Step 3 performs peak recording level setting out. CPU10 amends the bias determined at Step 3 based on the table 2 (drawing 5) of peak recording level correction value to the bias memorized by the memory 15. For example, when bias is chosen as UNDER, It is amended by -4.7dBV which is the value lowered 0.7 dB from recording level initial value-4.0dBV by which temporary setting is carried out in order that MOL may show a value (deviation of MOL to the bias REF) low 0.7 dB compared with the time of bias being REF (Step 6).

[0026]

[0019]Next, MOL is amended from the tape sensitivity measured at Step 5, and peak recording level setting out is performed. For example, inclination 0.7 (chromium type) of the tape sensitivity pair MOL characteristic currently held as the table 3 (drawing 6) at the memory 15 as tape sensitivity is +1.3 dB is used, +calculating with 1.3x0.7=0.9dB (deviation of MOL to the tape sensitivity 0) -- MOL -- +-- it turns out that it is high 0.9 dB. Therefore, a peak recording level is determined as -4.7dBV+0.9-dB=-3.8dBV (Step 7).

[0027]

[0020]Although MOL was calculated from tape sensitivity and the adjusted bias in a 1st embodiment, MOL may be calculated only with tape sensitivity in the fixed bias recorder which does not adjust bias. Although tape sensitivity and the relation of MOL were approximated according to proportionality (primary function) and performed in a 1st embodiment, tape sensitivity and the relation of MOL may approximate with two or more function etc.

[0028]

[0021]Although MOL was calculated by the operation using the coefficient for an operation memorized by the memory in a 1st embodiment, the table showing the relation of MOL to much tape sensitivity is memorized in the memory, and MOL may be calculated using this table. Although it asked for the bias of a standard, and the deviation of MOL by tape sensitivity, the peak recording level initial value was amended and the peak recording level was determined in a 1st embodiment, MOL may be calculated from the table in the measured tape sensitivity, use bias, and a memory, only a predetermined value may make a level go up and down from the MOL, and a peak recording level may be determined based on MOL.

[0029]

[0022][A 2nd embodiment] The input-output behavioral characteristics of high signalling frequency determine

a peak recording level. In high predetermined signalling frequency, for example, a 10-kHz signal, if the characteristic of an input output level difference to an input level is measured, the tendency for an input output level difference to become large will be seen as an input level becomes high. The input output level difference said here is a level difference which lengthened the output level which is a signal level which played the signal from the tape from the input level which is a level of the signal recorded on the tape. Thus, there is correlation in an input level and an input output level difference. Since this input output level difference appears notably in high signalling frequency, if an input output level difference is 0 in high signalling frequency, the input output level difference in frequency lower than it is 0. And if this input output level difference is 0, it can be said that sound recording faithful to the HARASHIN item is possible, and it is good sound recording.
[0030]
[0023]Therefore, it asks for the input level at the time of being the input output level difference 0 from the measured input output level difference based on the characteristic of an input output level difference to this input level. A peak recording level can be determined by furthermore taking the frequency characteristic of a music signal into consideration. In this embodiment, since proportionality is mostly looked at by the correlation of an input level and an input output level difference, both correlation is approximated to proportionality. The characteristic figure in a chromium type is shown in drawing 7. If it is the same tape type, even if bias will change, the almost same inclination is shown. However, although not illustrated, tape types other than a chromium type also show proportionality mostly, but a chromium type differs from inclination.
[0031]
[0024]Concrete operation is explained using drawing 2 and drawing 8. The tape type of the tape recorded by the type detection means 11 is detected (Step 11). For example, suppose that the chromium type was detected.
[0032]
[0025]CPU10 controls to output the test signal of 10 kHz and -6dBV with the test signal oscillator 13. A test signal is recorded and played by the tape 5, and CPU10 detects the input output level difference of a test signal with the regeneration level which the level detection circuit 14 detected (Step 12).
[0033]
[0026]Next, an input output level difference calculates the input level used as 0 from the input output level difference which CPU10 detected. The inclination of the input output level difference characteristic to the input level according to a tape type is memorized on the table 4 (drawing 9) in the memory 15. Here, since the tape type is detected with the chromium type at Step 11, it inclines and -1.6 is used for the operation of an input level. For example, supposing the input output level difference detected at Step 12 is -3dB, in order to set an input output level difference to 0, it is necessary to contract this difference of only 3 dB for Masakata. So, if 3 dB is multiplied by inclination-1.6 of the chromium type characteristic, in order to be set to 3dBx-1.6=-4.8dB and to set an input output level difference to 0, it is necessary to use an input level of only 4.8 dB [level / (-6dBV) / of a test signal] as a low level. That is, if an input level is less than -6dBV-4.8dB=-10.8dBV, it will be thought that the input level difference is 0. However, if frequency analysis of a music signal is conducted, also in the music signal which includes the high-frequency component most, a 10-kHz level of not less than 7.5 dB used as a test signal is low compared with the level of all the zones. For this reason, as a peak recording level, it is decided that it will be -10.8dBV+7.5-dB=-3.3dBV (Step 13).
[0034]
[0027]Although it asked for the input level in the input output level difference 0 by the operation using the coefficient for an operation memorized by the memory in a 2nd embodiment, The table showing the relation of the input level to many input output level differences is memorized in the memory, and it may ask for an input level in case an input output level difference is 0 using this table. Although the input level and the relation of the input output level difference were approximated according to proportionality (primary function) and performed in a 2nd embodiment, tape sensitivity and the relation of MOL may approximate with two or more function etc.
[0035]
[0028][A 3rd embodiment] This embodiment determines a still higher-precision peak recording level using both of the peak recording level determination by the frequency characteristic of the high frequency signal shown in the peak recording level determination and a 2nd embodiment by the sensitivity shown in a 1st embodiment.
[0036]
[0029]Concrete operation is explained using drawing 10. First, Step 7 is performed from Step 1 of a 1st

embodiment. The 1st peak recording level determined at Step 7 is held in the memory 15 (Step 31). The 1st peak recording level is −3.8dBV in the example currently given here.
[0037]
[0030]Next, Step 13 is performed from Step 11 of a 2nd embodiment, the 2nd peak recording level is determined, and it memorizes in the memory 15 (Step 32). The 2nd peak recording level is −3.3dBV in the example currently given here.
[0038]
[0031]Next, CPU10 compares 1st and 2nd peak recording level both, and it chooses a low value. Here, −3.8dBV which is the 1st peak recording level is chosen. If it records on a bigger level than the 1st peak recording level, distortion will become large, the reason for choosing both lower one poses an audibility top problem, and when it is recorded with a bigger value than the 2nd peak recording level, it is because it becomes the sound recording with which it was filled, without obtaining an output level to an input level. And the value selected here is determined as an optimal peak recording level (Step 33).
[0039]
[0032]The detection operation of the tape type performed at Step 32 may be omitted, and may use the tape type detection result of Step 31.
[0040]
[0033]Step 4 and Step 12 which detect tape characteristics by a test signal may be performed continuously.
[0041]
[0034]

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The MOL characteristic to the tape sensitivity in a chromium type
[Drawing 2]The lineblock diagram of this invention
[Drawing 3]The flow chart of a 1st embodiment
[Drawing 4]The table 1 showing the initial value over a tape type
[Drawing 5]The table 2 showing the correction amount to a tape type and bias
[Drawing 6]The table 3 showing the inclination of the characteristic to a tape type
[Drawing 7]The input level characteristic to the input output level difference in a chromium type
[Drawing 8]The flow chart of a 2nd embodiment
[Drawing 9]The table 4 showing the inclination of the characteristic to a tape type
[Drawing 10]The flow chart of a 3rd embodiment
[Brief Description of Notations]
1 ... Input terminal
2 ... Input volume
3 ... Sound recording amplifier
4 ... Recording head
5 ... Tape
6 ... Bias oscillator
7 ... Playback head
8 ... Playback amplifier
9 ... Output terminal
10 .. CPU
11 .. Type detection means
12 .. Sound recording calibration volume
13 .. Test signal oscillator
14 .. Level detection circuit
15 .. Memory

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 4]

テーブル1

テープタイプ	初期値
クロム	−4．0dBV
メタル	−4．0dBV

[Drawing 5]

テーブル2

テープタイプ	バイアス	補正量
クロム	OVER	+0．8dB
	REF	0．0dB
	UNDER	−0．7dB
メタル	OVER	0．0dB
	REF	0．0dB
	UNDER	−0．4dB

[Drawing 6]

テーブル3

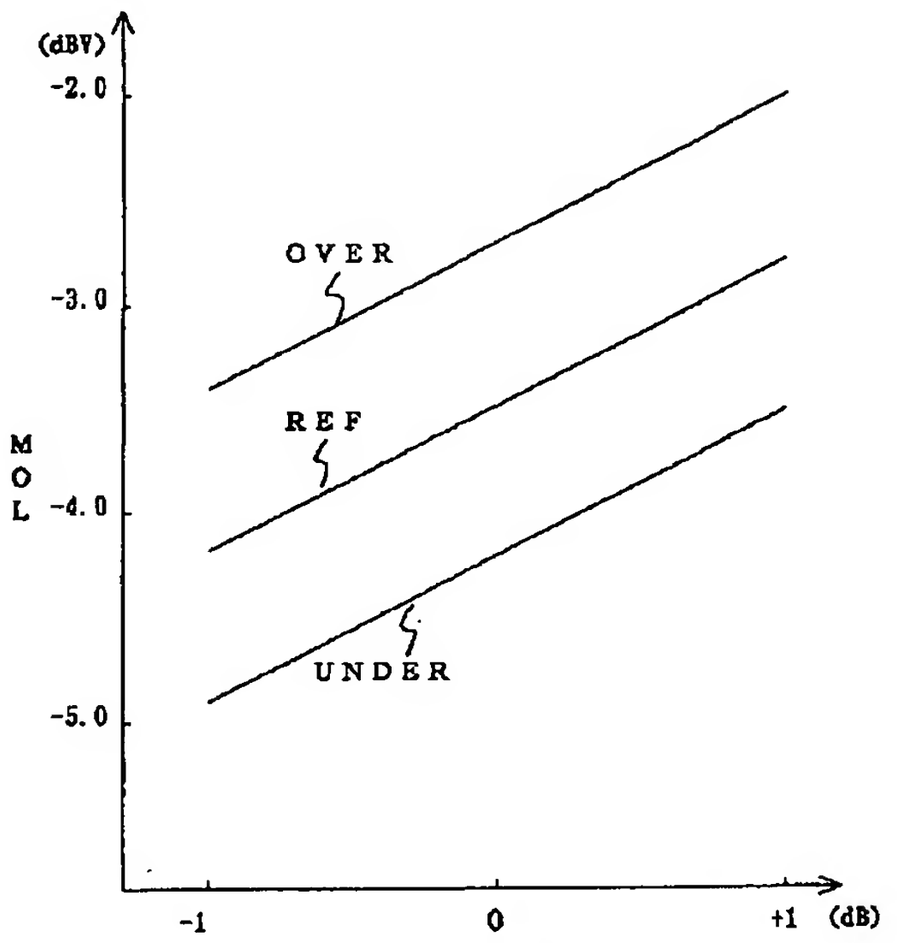
テープタイプ	特性の傾き
クロム	0．7
メタル	0．2

[Drawing 9]

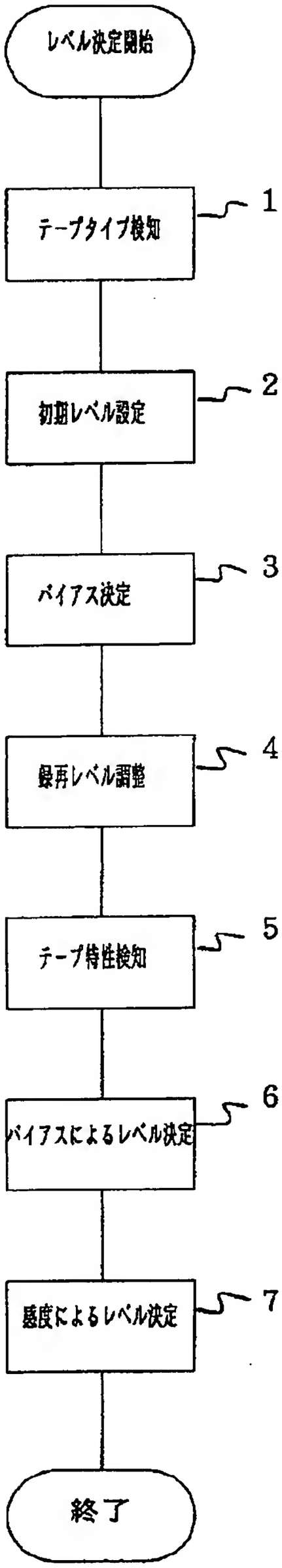
テーブル4

テープタイプ	特性の傾き
ノーマル	−1．2
クロム	−1．6

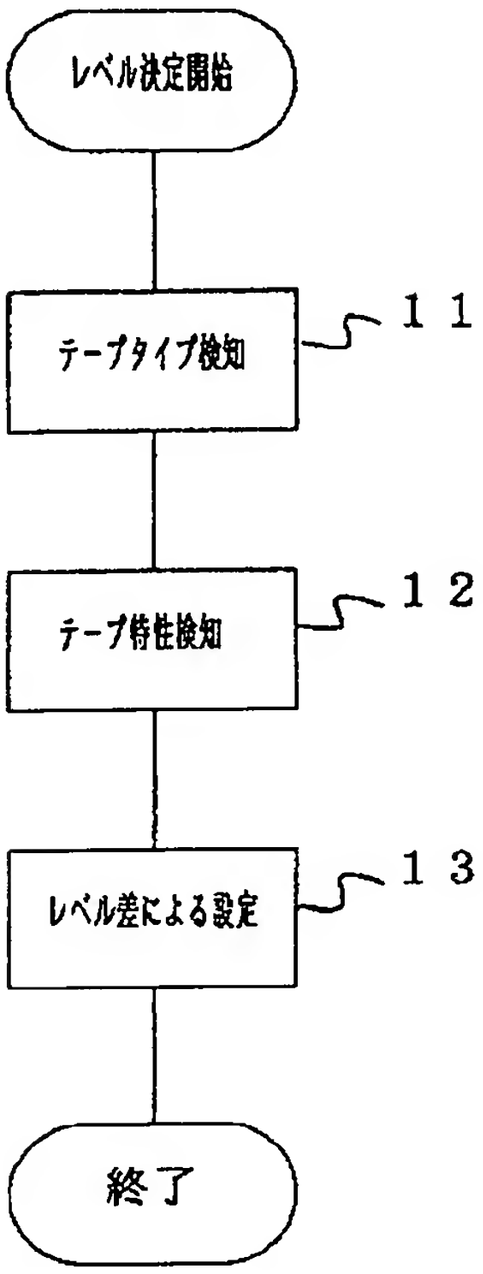
[Drawing 1]



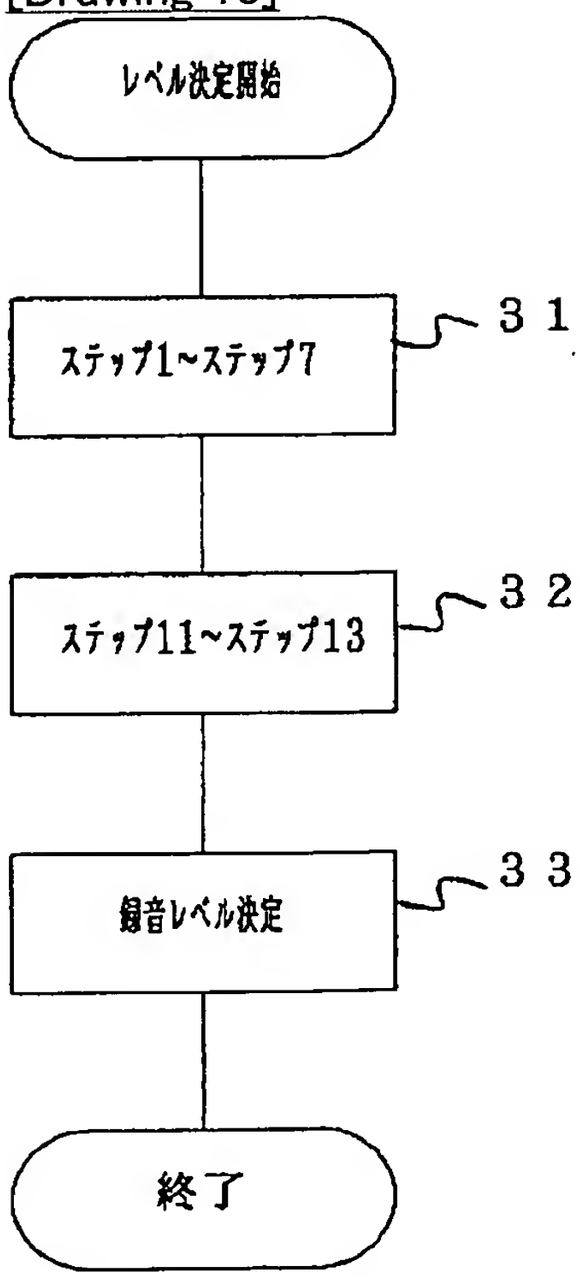
[Drawing 3]


レベル決定開始
テープタイプ検知
1
初期レベル設定
2
バイアス決定
3
録再レベル調整
4
テープ特性検知
5
バイアスによるレベル決定
6
感度によるレベル決定
7
終了

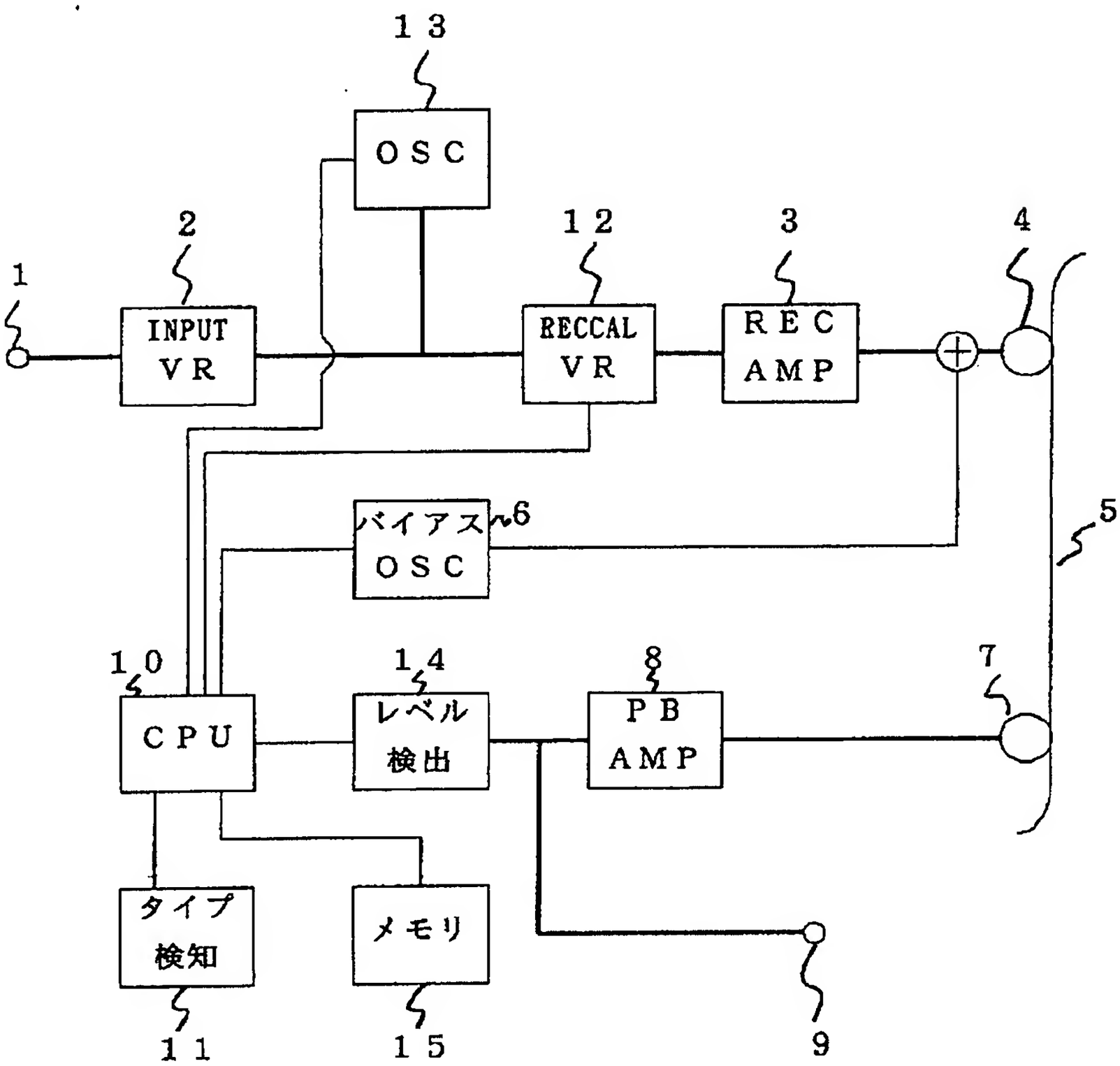
[Drawing 8]



[Drawing 10]



[Drawing 2]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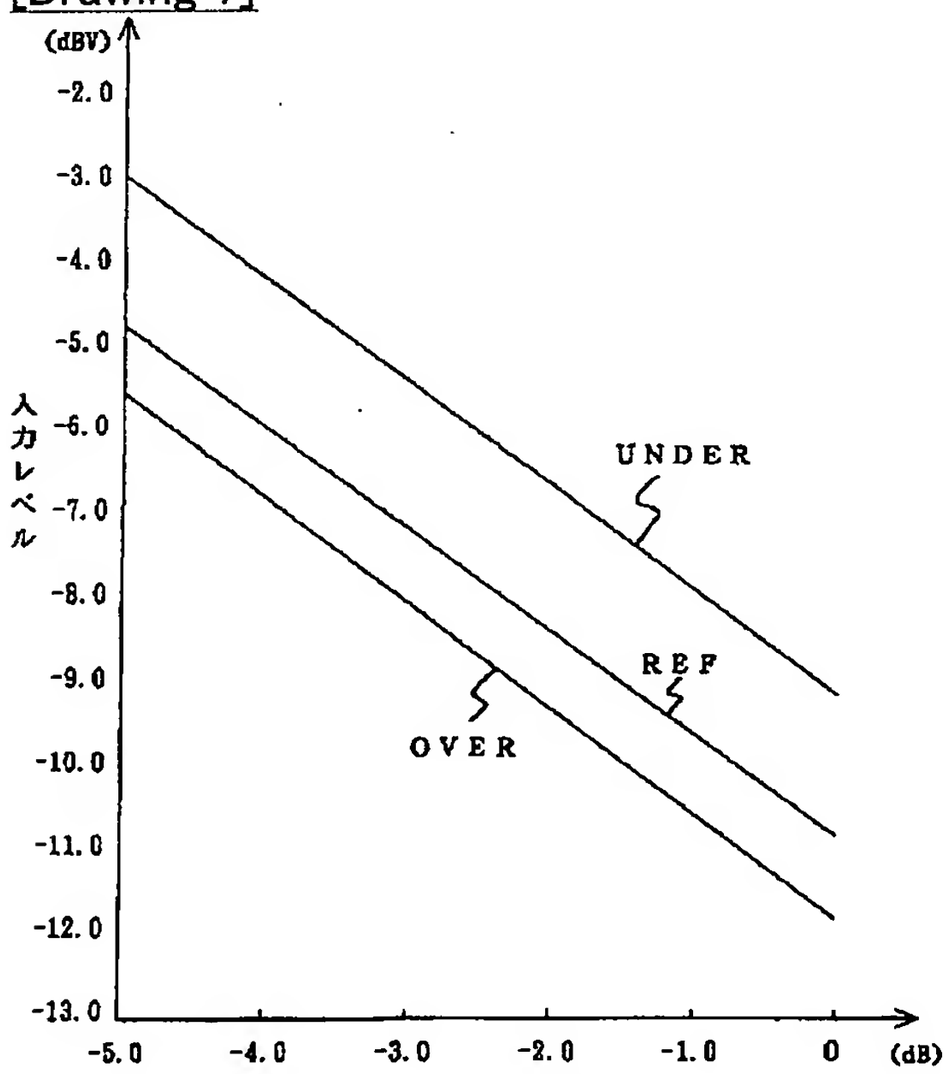
2
1
INPUT
VR
12
RECCAL
VR
3
REC
AMP
4
5
バイアス
OSC
6
10
CPU
14
レベル
検出
8
PB
AMP
7
タイプ
検知
メモリ
11
15
9

[Drawing 7]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-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
入力レベル
UNDER
REF
OVER
-5.0
-4.0
-3.0
-2.0
-1.0
0
(dB)
入出力レベル差

[Translation done.]

* NOTICES *

WRITTEN AMENDMENT

---------- [Written amendment]
[Filing date]December 16, Heisei 8
[Amendment 1]
[Document to be Amended]Specification
[Item(s) to be Amended]DETAILED DESCRIPTION
[Method of Amendment]Change
[Proposed Amendment]
[Detailed Description of the Invention]
[0001]
[Industrial Application]It is related with the recorder which determines a peak recording level automatically.
[0002]
[Description of the Prior Art]It is known by a tape type that tape characteristics, such as tape sensitivity, differ, the tape type of the tape to be used was detected, and there was a device which determines the peak recording level beforehand decided according to the tape type.
[0003]
[Problem(s) to be Solved by the Invention]However, if the maker or brand manufactured even when a tape type is the same is different, tape characteristics differ, and in setting out of the peak recording level only by a tape type, setting out of the optimal peak recording level cannot be performed. Then, this invention measures the characteristic of the recording medium to be used, and it is setting up the peak recording level according to the measurement data, and aims at attaining good sound recording.
[0004]
[Means for Solving the Problem]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 1 records a signal to a recording medium, A test signal generating means which generates a test signal, and a memory measure which has memorized a relation of MOL to recording sensitivity of a recording medium, It has a recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, It asks for a deviation of MOL of said recording medium, or MOL based on a relation which recording sensitivity and said memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, and a peak recording level is determined based on a deviation of this MOL or MOL.
[0005]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 2 records a signal to a recording medium, A test signal generating means which generates a test signal, and the 1st memory measure that has memorized a relation of MOL to recording sensitivity of a recording medium, A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, A bias determination means to determine proper bias which is bias suitable for said recording medium, It has the 2nd memory measure that memorizes a relation of MOL to bias, It asks for a deviation of MOL of said recording medium, or MOL based on a relation which recording sensitivity, said proper bias, and said 1st and 2nd memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, and a peak recording level is determined based on a deviation of this MOL or MOL.
[0006]In a recorder which has a playback head which plays a signal from a recording head and a recording

medium with which the invention according to claim 3 records a signal to a recording medium, A test signal generating means which generates a test signal, and a memory measure which has memorized beforehand a relation of an input level to an input output level difference, It has a level difference measuring means which measures an input output level difference by recording and playing said test signal to said recording medium, It asks for an input level corresponding to a predetermined input output level difference of said recording medium based on a relation which a level difference which said level difference measuring means measured, and said memory measure have memorized, and a peak recording level is determined based on this input level.
[0007]In a recorder which has a playback head which plays a signal from a recording head and a recording medium with which the invention according to claim 4 records a signal to a recording medium, A test signal generating means which generates a test signal, and the 1st memory measure that has memorized beforehand a relation of MOL to recording sensitivity of a recording medium, The 2nd memory measure that has memorized beforehand a relation of an input level to an input output level difference, A recording sensitivity measuring means which measures recording sensitivity of a recording medium by recording and playing said test signal to said recording medium, A level difference measuring means which measures an input output level difference by recording and playing said test signal to said recording medium, Have a comparison means to compare size of a recording level, and it asks for a deviation of MOL of a recording medium, or MOL based on a relation which recording sensitivity and said 1st memory measure of a recording medium which said recording sensitivity measuring means measured have memorized, The 1st recording level determined based on a deviation of this MOL or MOL, Ask for an input level corresponding to a predetermined input output level difference of a recording medium to be used based on a relation which a level difference which said level difference measuring means measured, and said 2nd memory measure have memorized, and said comparison means compares the 2nd recording level determined based on this input level, and The 1st, A low value is determined as a peak recording level among the 2nd recording level.
[0008]
[Example]Hereafter, the details of an embodiment of the invention are explained based on a drawing.
[0009][A 1st embodiment] Let 3% of 3rd harmonic distortion be a rule of thumb as a distortion amount generally permitted on audibility. So, in a 1st embodiment, a peak recording level decision is made based on the deviation of MOL (output level from which the 3rd harmonic distortion will be 3% when it records by predetermined bias current), or MOL.
[0010]The characteristic of MOL to the tape sensitivity (difference of the output level to an input level) which is the recording sensitivity of a recording medium in a predetermined test signal was measured using various chromium type tapes in which a maker differs from a brand. MOL is as high as a tape with a high output level, and the tendency for MOL to be low is known with this result to sufficient namely, tape sensitivity by the tape with conversely worse tape sensitivity. Thus, there is correlation in tape sensitivity and MOL. The MOL characteristic to tape sensitivity shows the same characteristic also by Normal other than a chromium type, and a metal type.
[0011]In this embodiment, this correlation is used, it asks for the deviation of MOL or MOL from tape sensitivity, and a peak recording level is determined from the deviation of this MOL or MOL. In this embodiment, since proportionality is mostly looked at by the correlation of tape sensitivity and MOL, both correlation is approximated to proportionality and performed. The characteristic figure (chromium type) is shown in drawing 1. However, since the MOL characteristics to tape sensitivity differ with every tape type, it is necessary to use the inclination etc. which were doubled with the tape type.
[0012]Drawing 2 is circuitry of a 1st embodiment. The signal inputted from the input terminal 1 via the sound recording calibration volume 12 which adjusts the signal level by the input volume 2 which changes a signal level, and tape sensitivity, After the sound recording amplifier 3 is supplied and being amplified with this sound recording amplifier 3, it is recorded by the recording head 4 by the tape 5 which is a recording medium. The test signal by the test signal oscillator 13 which oscillates a test signal is similarly recorded via the sound recording calibration volume 12 and the sound recording amplifier 3. The playback head 7 is reproduced, and the signal recorded by the tape 5 is amplified by the playback amplifier 8, and is outputted to the output terminal 9. The output level of the tape which was played by the playback head 7 and amplified with the playback amplifier 8 is detected in the level detection circuit 14, and is incorporated into central processing unit CPU10. CPU10 determines the level of suitable bias and the sound recording calibration volume 12 with the data detected by the output level of a test signal, the frequency, and the level detection circuit 14 which the test signal generator 13 generates. CPU10 determines the optimal peak recording level based on these

decision results.
[0013]Concrete operation is explained using drawing 2 and drawing 3. The tape type of the tape which is a recording medium is detected by the type detection means 11 (Step 1).
[0014]CPU10 carries out temporary setting of the peak recording level initial value based on the table 1 (drawing 4) memorized by the detected tape type and the memory 15 (Step 2). This peak recording level initial value is determined as the level which can perform good sound recording by measurement and an audition of MOL of the tape (tape sensitivity is 0) of the standard characteristic, S/N, etc. For example, by a chromium type, temporary setting is carried out to -4.0dBV. Since it is measured using the bias of a standard (REF), this value needs to amend, when bias amounts differ.This amendment is performed at the below-mentioned step 6.

[0015]Next, adjustment of bias is performed so that the sound recording reproduction frequency characteristic of a tape may become a flat. The test signal oscillator 13 bias adjustment 400 Hz, -23dBV, and 10 kHz, -Output the test signal of 23dBV, change bias to the three-stage of OVER (deep compared with a standard), REF (standard), and UNDER (shallow compared with a standard) with the bias oscillator 6, and record each test signal. And both test signals are reproduced by the playback head 7, bias amounts when the output level of both test signals shows the nearest value are chosen as rated bias, and the bias oscillator 6 is set as these bias amounts. (Step 3).
[0016]Next, sound recording sensitivity is adjusted so that the difference of the input level to a tape and an output level may be set to 0. While the test signal oscillator 13 outputs the test signal of 400 Hz and -23dBV and carries out the sweep of the volume of the sound recording calibration volume 12, it records on the tape 5. Then, a sweep signal is played from the tape 5. At the time of this playback, CPU10 compares the output level of the test signal generator 13 with the data detected by the level detection circuit 14, and it sets up the sound recording calibration volume 12 so that a difference may be set to 0 (Step 4).
[0017]Next, tape sensitivity is measured. The initial volume position before adjustment of the sound recording calibration volume 12 in Step 4, Since the difference of an input level and an output level is a position used as 0 in the tape of the standard characteristic mentioned above and the amount of adjustments of the sound recording calibration volume 12 in Step 4 is the tape sensitivity itself, The amount of adjustments of the sound recording calibration volume 12 of Step 4 is memorized in the memory 15. (Step 5).
[0018]Next, the bias selected at Step 3 performs peak recording level setting out. CPU10 amends the bias determined at Step 3 based on the table 2 (drawing 5) of peak recording level correction value to the bias memorized by the memory 15. For example, when bias is chosen as UNDER, It is amended by -4.7dBV which is the value lowered 0.7 dB from recording level initial value-4.0dBV by which temporary setting is carried out in order that MOL may show a value (deviation of MOL to the bias REF) low 0.7 dB compared with the time of bias being REF (Step 6).
[0019]Next, MOL is amended from the tape sensitivity measured at Step 5, and peak recording level setting out is performed. For example, inclination 0.7 (chromium type) of the tape sensitivity pair MOL characteristic currently held as the table 3 (drawing 6) at the memory 15 as tape sensitivity is +1.3 dB is used, +calculating with 1.3x0.7=0.9dB (deviation of MOL to the tape sensitivity 0) -- MOL -- +-- it turns out that it is high 0.9 dB. Therefore, a peak recording level is determined as -4.7dBV+0.9-dB=-3.8dBV (Step 7).
[0020]Although MOL was calculated from tape sensitivity and the adjusted bias in a 1st embodiment, MOL may be calculated only with tape sensitivity in the fixed bias recorder which does not adjust bias. Although tape sensitivity and the relation of MOL were approximated according to proportionality (primary function) and performed in a 1st embodiment, tape sensitivity and the relation of MOL may approximate with two or more function etc.
[0021]Although MOL was calculated by the operation using the coefficient for an operation memorized by the memory in a 1st embodiment, the table showing the relation of MOL to much tape sensitivity is memorized in the memory, and MOL may be calculated using this table. Although it asked for the bias of a standard, and the deviation of MOL by tape sensitivity, the peak recording level initial value was amended and the peak recording level was determined in a 1st embodiment, MOL may be calculated from the table in the measured tape sensitivity, use bias, and a memory, only a predetermined value may make a level go up and down from the MOL, and a peak recording level may be determined based on MOL.
[0022][A 2nd embodiment] The input-output behavioral characteristics of high signalling frequency determine a peak recording level. In high predetermined signalling frequency, for example, a 10-kHz signal, if the characteristic of an input output level difference to an input level is measured, the tendency for an input

output level difference to become large will be seen as an input level becomes high. The input output level difference said here is a level difference which lengthened the output level which is a signal level which played the signal from the tape from the input level which is a level of the signal recorded on the tape. Thus, there is correlation in an input level and an input output level difference. Since this input output level difference appears notably in high signalling frequency, if an input output level difference is 0 in high signalling frequency, the input output level difference in frequency lower than it is 0. And if this input output level difference is 0, it can be said that sound recording faithful to the HARASHIN item is possible, and it is good sound recording.
[0023]Therefore, it asks for the input level at the time of being the input output level difference 0 from the measured input output level difference based on the characteristic of an input output level difference to this input level. A peak recording level can be determined by furthermore taking the frequency characteristic of a music signal into consideration. In this embodiment, since proportionality is mostly looked at by the correlation of an input level and an input output level difference, both correlation is approximated to proportionality. The characteristic figure in a chromium type is shown in drawing 7. If it is the same tape type, even if bias will change, the almost same inclination is shown. However, although not illustrated, tape types other than a chromium type also show proportionality mostly, but a chromium type differs from inclination.
[0024]Concrete operation is explained using drawing 2 and drawing 8. The tape type of the tape recorded by the type detection means 11 is detected (Step 11). For example, suppose that the chromium type was detected.
[0025]CPU10 controls to output the test signal of 10 kHz and -6dBV with the test signal oscillator 13. A test signal is recorded and played by the tape 5, and CPU10 detects the input output level difference of a test signal with the regeneration level which the level detection circuit 14 detected (Step 12).
[0026]Next, an input output level difference calculates the input level used as 0 from the input output level difference which CPU10 detected. The inclination of the input output level difference characteristic to the input level according to a tape type is memorized on the table 4 (drawing 9) in the memory 15. Here, since the tape type is detected with the chromium type at Step 11, it inclines and -1.6 is used for the operation of an input level. For example, supposing the input output level difference detected at Step 12 is -3dB, in order to set an input output level difference to 0, it is necessary to contract this difference of only 3 dB for Masakata. So, if 3 dB is multiplied by inclination-1.6 of the chromium type characteristic, in order to be set to 3dBx-1.6=-4.8dB and to set an input output level difference to 0, it is necessary to use an input level of only 4.8 dB [level / (-6dBV) / of a test signal] as a low level. That is, if an input level is less than -6dBV-4.8dB=-10.8dBV, it will be thought that the input level difference is 0. However, if frequency analysis of a music signal is conducted, also in the music signal which includes the high-frequency component most, a 10-kHz level of not less than 7.5 dB used as a test signal is low compared with the level of all the zones. For this reason, as a peak recording level, it is decided that it will be -10.8dBV+7.5-dB=-3.3dBV (Step 13).
[0027]Although it asked for the input level in the input output level difference 0 by the operation using the coefficient for an operation memorized by the memory in a 2nd embodiment, The table showing the relation of the input level to many input output level differences is memorized in the memory, and it may ask for an input level in case an input output level difference is 0 using this table. Although the input level and the relation of the input output level difference were approximated according to proportionality (primary function) and performed in a 2nd embodiment, tape sensitivity and the relation of MOL may approximate with two or more function etc.
[0028][A 3rd embodiment] This embodiment determines a still higher-precision peak recording level using both of the peak recording level determination by the frequency characteristic of the high frequency signal shown in the peak recording level determination and a 2nd embodiment by the sensitivity shown in a 1st embodiment.
[0029]Concrete operation is explained using drawing 10. First, Step 7 is performed from Step 1 of a 1st embodiment. The 1st peak recording level determined at Step 7 is held in the memory 15 (Step 31). The 1st peak recording level is -3.8dBV in the example currently given here.
[0030]Next, Step 13 is performed from Step 11 of a 2nd embodiment, the 2nd peak recording level is determined, and it memorizes in the memory 15 (Step 32). The 2nd peak recording level is -3.3dBV in the example currently given here.
[0031]Next, CPU10 compares 1st and 2nd peak recording level both, and it chooses a low value. Here, -3.8dBV which is the 1st peak recording level is chosen. If it records on a bigger level than the 1st peak recording level, distortion will become large, the reason for choosing both lower one poses an audibility top problem, and when it is recorded with a bigger value than the 2nd peak recording level, it is because it

becomes the sound recording with which it was filled, without obtaining an output level to an input level. And the value selected here is determined as an optimal peak recording level (Step 33).
[0032]The detection operation of the tape type performed at Step 32 may be omitted, and may use the tape type detection result of Step 31.
[0033]Step 4 and Step 12 which detect tape characteristics by a test signal may be performed continuously.
[0034]
[Effect of the Invention]Thus, since record and playback of a test signal are performed and a peak recording level is determined from the characteristic of recording media, such as tape sensitivity, the peak recording level which fully used the capability of the recording medium to be used can be determined.

[Translation done.]

1-3

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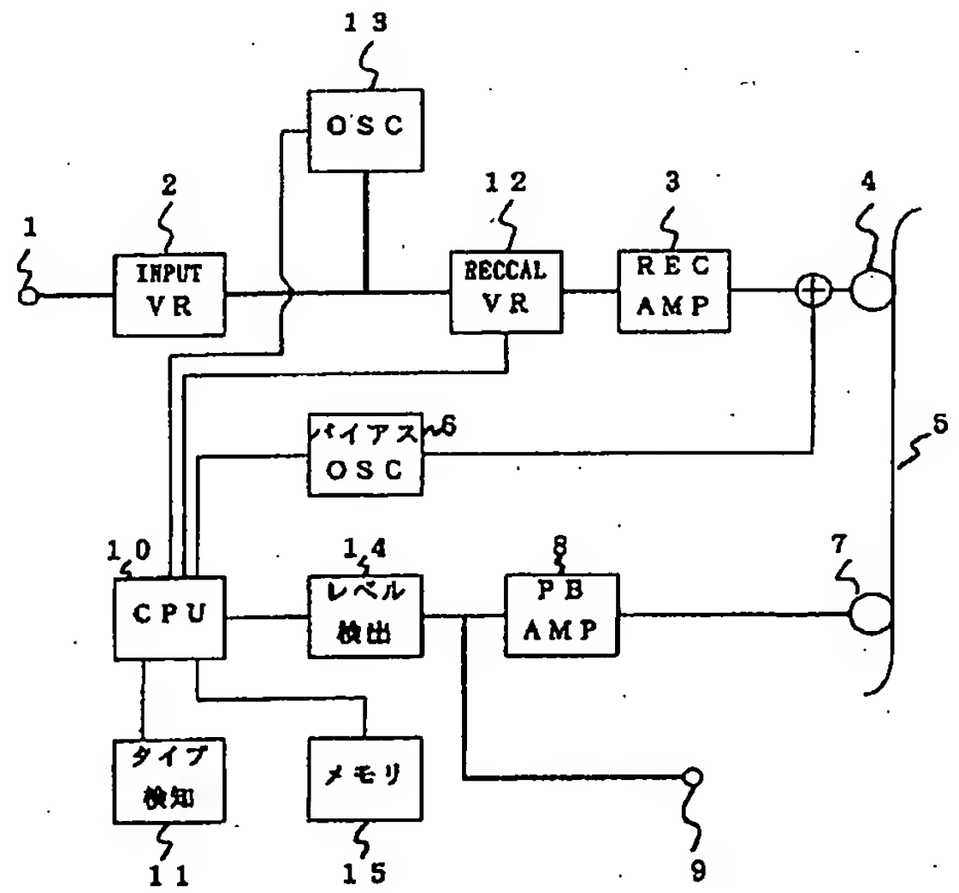
最終頁に続く

(54)【発明の名称】　記録装置

(57)【要約】
【課題】使用するテープなどの記録媒体の特性に応じた、ピーク録音レベルを決定する。
【解決手段】テープ感度とＭＯＬの相関関係を利用し、テープ感度からＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差からピーク録音レベルを決定する。また、入力レベルと入出力レベル差の相関関係を利用し、測定した入出力レベル差から入出力レベル差０であるときの入力レベルを求める。さらに音楽信号の周波数特性を考慮することによりピーク録音レベルを決定する。



【特許請求の範囲】
【請求項１】記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、
テスト信号を発生するテスト信号発生手段と、
記録媒体の記録感度に対するＭＯＬの関係を記憶している記憶手段と、
前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段とを有し、
前記記録感度測定手段の測定した記録媒体の記録感度及び前記記憶手段が記憶している関係に基づき前記記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づきピーク録音レベルを決定することを特徴とする記録装置。
【請求項２】記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、
テスト信号を発生するテスト信号発生手段と、
記録媒体の記録感度に対するＭＯＬの関係を記憶している第１の記憶手段と、
前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段と、
前記記録媒体に適したバイアスである適正バイアスを決定するバイアス決定手段と、
バイアスに対するＭＯＬの関係を記憶する第２の記憶手段とを有し、
前記記録感度測定手段の測定した記録媒体の記録感度、前記適正バイアス及び前記第１、第２の記憶手段が記憶している関係に基づき前記記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づきピーク録音レベルを決定することを特徴とする記録装置。
【請求項３】記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、
テスト信号を発生するテスト信号発生手段と、
入出力レベル差に対する入力レベルの関係を予め記憶している記憶手段と、
前記記録媒体に前記テスト信号を録音及び再生することにより入出力レベル差を測定するレベル差測定手段とを有し、
前記レベル差測定手段の測定したレベル差及び前記記憶手段が記憶している関係に基づき、前記記録媒体の所定の入出力レベル差に対応する入力レベルを求め、この入力レベルに基づきピーク録音レベルを決定することを特徴とする記録装置。
【請求項４】記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、
テスト信号を発生するテスト信号発生手段と、
記録媒体の記録感度に対するＭＯＬの関係を予め記憶している第１の記憶手段と、
入出力レベル差に対する入力レベルの関係を予め記憶している第２の記憶手段と、
前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段と、
前記記録媒体に前記テスト信号を録音及び再生することにより入出力レベル差を測定するレベル差測定手段と、
録音レベルの大小を比較する比較手段とを有し、
前記記録感度測定手段の測定した記録媒体の記録感度及び前記第１の記憶手段が記憶している関係に基づき記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づき決定した第１の録音レベルと、前記レベル差測定手段の測定したレベル差及び前記第２の記憶手段が記憶している関係に基づき、使用する記録媒体の所定の入出力レベル差に対応する入力レベルを求め、この入力レベルに基づき決定した第２の録音レベルとを前記比較手段により比較し、第１、第２の録音レベルのうち低い値をピーク録音レベルとして決定することを特徴とする記録装置。
【発明の詳細な説明】
【０００１】
【０００１】
【０００２】
【産業上の利用分野】ピーク録音レベルを自動的に決定する記録装置に関する。
【０００３】
【０００２】
【０００４】
【従来の技術】テープタイプによってテープ感度などのテープ特性が異なることが知られており、使用するテープのテープタイプを検知して、そのテープタイプに応じて予め決められたピーク録音レベルを決定する装置があった。
【０００５】
【０００３】
【０００６】
【発明が解決しようとする課題】しかし、テープタイプが同一でも製造するメーカーまたはブランドが異なればテープ特性は異なり、テープタイプだけによるピーク録音レベルの設定では、最適なピーク録音レベルの設定は行えないものであった。
【０００７】そこで、本発明は使用する記録媒体の特性を測定し、その測定データに応じたピーク録音レベルを設定することで、良好な録音を達成することを目的とする。
【０００８】
【０００４】

【０００９】
【課題を解決するための手段】請求項１に記載の発明は、記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、テスト信号を発生するテスト信号発生手段と、記録媒体の記録感度に対するＭＯＬの関係を記憶している記憶手段と、前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段とを有し、前記記録感度測定手段の測定した記録媒体の記録感度及び前記記憶手段が記憶している関係に基づき前記記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づきピーク録音レベルを決定することを特徴とする。
【００１０】
【０００５】請求項２に記載の発明は、記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、テスト信号を発生するテスト信号発生手段と、記録媒体の記録感度に対するＭＯＬの関係を記憶している第１の記憶手段と、前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段と、前記記録媒体に適したバイアスである適正バイアスを決定するバイアス決定手段と、バイアスに対するＭＯＬの関係を記憶する第２の記憶手段とを有し、前記記録感度測定手段の測定した記録媒体の記録感度、前記適正バイアス及び前記第１、第２の記憶手段が記憶している関係に基づき前記記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づきピーク録音レベルを決定することを特徴とする。
【００１１】
【０００６】請求項３に記載の発明は、記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、テスト信号を発生するテスト信号発生手段と、入出力レベル差に対する入力レベルの関係を予め記憶している記憶手段と、前記記録媒体に前記テスト信号を録音及び再生することにより入出力レベル差を測定するレベル差測定手段とを有し、前記レベル差測定手段の測定したレベル差及び前記記憶手段が記憶している関係に基づき、前記記録媒体の所定の入出力レベル差に対応する入力レベルを求め、この入力レベルに基づきピーク録音レベルを決定することを特徴とする。
【００１２】
【０００７】請求項４に記載の発明は、記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、テスト信号を発生するテスト信号発生手段と、記録媒体の記録感度に対するＭＯＬの関係を予め記憶している第１の記憶手段と、入出力レベル差に対する入力レベルの関係を予め記憶している第２の記憶手段と、前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段と、前記記録媒体に前記テスト信号を録音及び再生することにより入出力レベル差を測定するレベル差測定手段と、録音レベルの大小を比較する比較手段とを有し、前記記録感度測定手段の測定した記録媒体の記録感度及び前記第１の記憶手段が記憶している関係に基づき記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づき決定した第１の録音レベルと、前記レベル差測定手段の測定したレベル差及び前記第２の記憶手段が記憶している関係に基づき、使用する記録媒体の所定の入出力レベル差に対応する入力レベルを求め、この入力レベルに基づき決定した第２の録音レベルとを前記比較手段により比較し、第１、第２の録音レベルのうち低い値をピーク録音レベルとして決定することを特徴とする。
【００１３】
【０００８】
【００１４】
【実施例】以下、本発明の実施の形態の詳細を図面に基づいて説明する。
【００１５】
【０００９】［第１の実施の形態］一般的に聴感上許容される歪み量として３次高調波歪み３％が目安とされている。そこで、第１の実施の形態ではＭＯＬ（所定のバイアス電流で録音を行った場合に３次高調波歪みが３％となる出力レベル）又はＭＯＬの偏差に基き、ピーク録音レベル決定する。
【００１６】
【００１０】メーカーやブランドが異なる種々のクロムタイプテープを用い、所定のテスト信号で記録媒体の記録感度であるテープ感度（入力レベルに対する出力レベルの差）に対するＭＯＬの特性を測定した。この結果からテープ感度の良い、すなわち出力レベルの高いテープほどＭＯＬは高く、逆にテープ感度の悪いテープほどＭＯＬが低い傾向がわかる。このように、テープ感度とＭＯＬには相関関係がある。さらに、クロムタイプ以外の例えばノーマル、メタルタイプでもテープ感度に対するＭＯＬ特性は同様の特性を示す。
【００１７】
【００１１】本実施の形態ではこの相関関係を利用し、テープ感度からＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差からピーク録音レベルを決定する。また、本実施の形態ではテープ感度とＭＯＬの相関関係にはほぼ比例関係が見られるため、両者の相関関係を比例関係に近似して行う。その特性図（クロムタイプ）を図１に示す。ただし、テープタイプ毎によりテープ感度に対するＭＯＬ特性は異なるため、テープタイプに合わせた傾きなどを用いる必要がある。
【００１８】
【００１２】図２は第１の実施の形態の回路構成であ

る。
【００１９】入力端子１から入力された信号は信号レベルを可変するインプットボリューム２およびテープ感度による信号レベルの調整を行う録音キャリブレーションボリューム１２を介して、録音アンプ３に供給され、この録音アンプ３で増幅された後に、録音ヘッド４によって記録媒体であるテープ５に録音される。また、テスト信号を発振するテスト信号発振器１３によるテスト信号も、同様に録音キャリブレーションボリューム１２及び録音アンプ３を介して録音される。テープ５に録音された信号は再生ヘッド７によって再生され、再生アンプ８によって増幅され、出力端子９に出力される。また、再生ヘッド７で再生され、再生アンプ８で増幅されたテープの出力レベルがレベル検出回路１４で検出され、中央演算処理装置ＣＰＵ１０に取り込まれる。ＣＰＵ１０はテスト信号発生器１３が発生するテスト信号の出力レベルと周波数、レベル検出回路１４により検出されたデータにより、適切なバイアスと録音キャリブレーションボリューム１２のレベルを決定する。さらに、ＣＰＵ１０はこの決定結果などをもとに、最適なピーク録音レベルを決定する。
【００２０】
【００１３】具体的な動作について、図２，図３を用いて説明する。タイプ検知手段１１により記録媒体であるテープのテープタイプが検知される（ステップ１）。
【００２１】
【００１４】ＣＰＵ１０は検知されたテープタイプとメモリ１５に記憶されているテーブル１（図４）に基づきピーク録音レベル初期値を仮設定する（ステップ２）。このピーク録音レベル初期値は、標準的な特性のテープ（テープ感度が０）のＭＯＬやＳ／Ｎなどの測定及び試聴により良好な録音ができるレベルに決定されている。例えば、クロムタイプでは－４．０ｄＢＶに仮設定される。なお、この値は基準（ＲＥＦ）のバイアスを用いて測定されているため、バイアス量が異なる時には補正を行う必要がある。この補正は後述のステップ６で行われる。
【００２２】
【００１５】次に、テープの録音再生周波数特性がフラットになるようにバイアスの調整が行われる。バイアス調整はテスト信号発振器１３が４００Ｈｚ、－２３ｄＢＶ及び１０ＫＨｚ、－２３ｄＢＶのテスト信号を出力し、各々のテスト信号をバイアス発振器６によりバイアスをＯＶＥＲ（基準に比べ深い）、ＲＥＦ（基準）、ＵＮＤＥＲ（基準に比べ浅い）の３段階に変化させて録音する。そして、両テスト信号を再生ヘッド７で再生し、両テスト信号の出力レベルが最も近い値を示したときのバイアス量を最適バイアスとして選択し、バイアス発振器６はこのバイアス量に設定される。（ステップ３）。
【００２３】
【００１６】次に、テープに対しての入力レベルと出力レベルの差が０になるように録音感度の調整を行う。テスト信号発振器１３が４００Ｈｚ、－２３ｄＢＶのテスト信号を出力し、録音キャリブレーションボリューム１２のボリュームをスイープしながらテープ５に録音する。その後、テープ５からスイープ信号を再生する。この再生時に、ＣＰＵ１０はレベル検出回路１４により検出されるデータと、テスト信号発生器１３の出力レベルの比較を行い、差が０になるように録音キャリブレーションボリューム１２を設定する（ステップ４）。
【００２４】
【００１７】次に、テープ感度を測定する。ステップ４での録音キャリブレーションボリューム１２の調整前の初期ボリューム位置は、前述した標準的な特性のテープにおいて、入力レベルと出力レベルとの差が０となる位置であるため、ステップ４での録音キャリブレーションボリューム１２の調整量がテープ感度そのものなので、ステップ４の録音キャリブレーションボリューム１２の調整量をメモリ１５に記憶する。（ステップ５）。
【００２５】
【００１８】次に、ステップ３で選択されたバイアスによりピーク録音レベル設定を行う。ＣＰＵ１０はステップ３で決定されたバイアスをメモリ１５に記憶されるバイアスに対するピーク録音レベル補正値のテーブル２（図５）に基づき補正を行う。例えば、バイアスがＵＮＤＥＲに選択された時は、バイアスがＲＥＦの時に比べてＭＯＬは０．７ｄＢ低い値（バイアスＲＥＦに対するＭＯＬの偏差）を示すため、仮設定されている録音レベル初期値－４．０ｄＢＶから０．７ｄＢ下げた値である－４．７ｄＢＶに補正される（ステップ６）。
【００２６】
【００１９】次に、ステップ５で測定されたテープ感度からＭＯＬを補正し、ピーク録音レベル設定を行う。例えば、テープ感度が＋１．３ｄＢであると、テーブル３（図６）としてメモリ１５に保持されているテープ感度対ＭＯＬ特性の傾き０．７（クロムタイプ）を用いて、＋１．３×０．７＝０．９ｄＢ（テープ感度０に対するＭＯＬの偏差）と演算され、ＭＯＬは＋０．９ｄＢ高いことが分かる。そのため、ピーク録音レベルは－４．７ｄＢＶ＋０．９ｄＢ＝－３．８ｄＢＶと決定される（ステップ７）。
【００２７】
【００２０】また、第１の実施の形態ではテープ感度及び調整したバイアスからＭＯＬを求めたが、バイアスの調整を行わない固定バイアス記録装置ではテープ感度のみによりＭＯＬを求めても良い。また、第１の実施の形態では、テープ感度とＭＯＬの関係を比例関係（１次関数）によって近似して行ったが、テープ感度とＭＯＬの関係は複数次の関数などで近似を行ってもよい。
【００２８】

【００２１】さらに、第１の実施の形態ではメモリに記憶されている演算用の係数を用いた演算によりＭＯＬを求めたが、メモリに多数のテープ感度に対するＭＯＬの関係を示したテーブルを記憶しておき、このテーブルを用いてＭＯＬを求めても良い。なお、第１の実施の形態では基準のバイアス、テープ感度によるＭＯＬの偏差を求め、ピーク録音レベル初期値を補正してピーク録音レベルの決定を行ったが、測定したテープ感度、使用バイアス及びメモリ内のテーブルからＭＯＬを求め、そのＭＯＬから所定値だけレベルを上下させるなどして、ＭＯＬに基づきピーク録音レベルを決定しても良い。

【００２９】

【００２２】［第２の実施の形態］高い周波数信号の入出力特性によりピーク録音レベルの決定をする。所定の高い周波数信号例えば１０ＫＨｚの信号において、入力レベルに対する入出力レベル差の特性を測定すると、入力レベルが高くなるにつれて入出力レベル差は大きくなる傾向が見られる。なお、ここで言う入出力レベル差とは、テープに記録した信号のレベルである入力レベルから、その信号をテープから再生した信号レベルである出力レベルを引いたレベル差である。このように、入力レベルと入出力レベル差には相関関係がある。また、高い周波数信号ではこの入出力レベル差が顕著にあらわれるため、高い周波数信号で入出力レベル差が０であれば、それより低い周波数での入出力レベル差は０である。そして、この入出力レベル差が０であれば、原信号に忠実な録音が可能であり、良好な録音であると言える。

【００３０】

【００２３】そのため、この入力レベルに対する入出力レベル差の特性を元に、測定した入出力レベル差から入出力レベル差０であるときの入力レベルを求める。さらに音楽信号の周波数特性を考慮することによりピーク録音レベルが決定できる。また、本実施の形態では入力レベルと入出力レベル差の相関関係にはほぼ比例関係が見られるため、両者の相関関係を比例関係に近似する。クロムタイプにおける、その特性図を図７に示す。また、同一テープタイプであればバイアスが変わってもほぼ同一の傾きを示す。ただし、図示しないがクロムタイプ以外のテープタイプでもほぼ比例関係は示すがクロムタイプと傾きは異なる。

【００３１】

【００２４】具体的な動作を図２，図８を用いて説明する。タイプ検知手段１１により記録されるテープのテープタイプが検知される（ステップ１１）。例えば、クロムタイプが検出されたとする。

【００３２】

【００２５】テスト信号発振器１３により１０ＫＨｚ、－６ｄＢＶのテスト信号を出力するようにＣＰＵ１０が制御する。テスト信号はテープ５に録音及び再生され、レベル検出回路１４の検出した再生レベルによりＣＰＵ１０がテスト信号の入出力レベル差を検出する（ステップ１２）。

【００３３】

【００２６】次に、ＣＰＵ１０が検出した入出力レベル差から、入出力レベル差が０となる入力レベルを演算する。テープタイプに応じた入力レベルに対する入出力レベル差特性の傾きがメモリ１５内のテーブル４（図９）に記憶されている。ここでは、ステップ１１でテープタイプがクロムタイプと検出されているので、傾き－１．６が入力レベルの演算に用いられる。例えば、ステップ１２で検出された入出力レベル差が－３ｄＢであったとすると、入出力レベル差を０にするためにはこの差を３ｄＢだけ正方向に縮める必要がある。そこで、３ｄＢにクロムタイプの特性の傾き－１．６を乗ずると、３ｄＢ×－１．６＝－４．８ｄＢとなり、入出力レベル差を０にするためには、入力レベルをテスト信号のレベル（－６ｄＢＶ）より、４．８ｄＢだけ低いレベルにする必要がある。つまり、入力レベルが－６ｄＢＶ－４．８ｄＢ＝－１０．８ｄＢＶ以下であれば、入力レベル差は０になっていると考えられる。ところが、音楽信号の周波数分析を行うと最も高域成分を含んでいる音楽信号においても、テスト信号として用いた１０ＫＨｚのレベルは全帯域のレベルに比べて７．５ｄＢ以上低くなっている。このために、ピーク録音レベルとしては－１０．８ｄＢＶ＋７．５ｄＢ＝－３．３ｄＢＶと決定される（ステップ１３）。

【００３４】

【００２７】また、第２の実施の形態ではメモリに記憶されている演算用の係数を用いた演算により入出力レベル差０における入力レベルを求めたが、メモリに多数の入出力レベル差に対する入力レベルの関係を示したテーブルを記憶しておき、このテーブルを用いて入出力レベル差が０であるときの入力レベルを求めても良い。なお、第２の実施の形態では、入力レベルと入出力レベル差の関係を比例関係（１次関数）によって近似して行ったが、テープ感度とＭＯＬの関係は複数次の関数などで近似を行ってもよい。

【００３５】

【００２８】［第３の実施の形態］本実施の形態は、第１の実施の形態に示した感度によるピーク録音レベル決定と第２の実施の形態に示した高周波信号の周波数特性によるピーク録音レベル決定の両者を用いて、さらに精度の高いピーク録音レベルの決定を行う。

【００３６】

【００２９】図１０を用いて、具体的な動作を説明する。まず、第１の実施の形態のステップ１からステップ７を行う。ステップ７で決定された第１ピーク録音レベルをメモリ１５に保持する（ステップ３１）。第１ピーク録音レベルはここで、あげられている例では－３．８ｄＢＶである。

【００３７】
【００３０】次に、第２の実施の形態のステップ１１からステップ１３を行い、第２ピーク録音レベルを決定し、メモリ１５に記憶する（ステップ３２）。第２ピーク録音レベルはここで、あげられている例では－３．３ｄＢＶである。
【００３８】
【００３１】次に、ＣＰＵ１０は第１、第２ピーク録音レベル両者を比較し、低い値を選択する。ここでは第１ピーク録音レベルである－３．８ｄＢＶが選択される。両者の低い方を選択する理由は、第１ピーク録音レベルより大きなレベルで記録すると、歪みが大きくなってしまい聴感上問題となる、また第２ピーク録音レベルより大きな値で記録すると、入力レベルに対して出力レベルが得られずに、こもった録音となるためである。そして、ここで選択された値を最適ピーク録音レベルとして決定する（ステップ３３）。
【００３９】
【００３２】また、ステップ３２で行われるテープタイプの検知動作は省略し、ステップ３１のテープタイプの検知結果を用いても良い。
【００４０】
【００３３】さらに、テスト信号によりテープ特性を検出するステップ４とステップ１２は続けて行っても良い。
【００４１】
【００３４】
【００４２】
【発明の効果】このように、テスト信号の記録及び再生を行い、テープ感度などの記録媒体の特性からピーク記録レベルを決定するため、使用する記録媒体の能力を十分に利用したピーク録音レベルが決定できる。

【図面の簡単な説明】
【図１】クロムタイプにおけるテープ感度に対するＭＯＬ特性
【図２】本発明の構成図
【図３】第１の実施の形態のフローチャート
【図４】テープタイプに対する初期値を示すテーブル１
【図５】テープタイプ及びバイアスに対する補正量を示すテーブル２
【図６】テープタイプに対する特性の傾きを示すテーブル３
【図７】クロムタイプにおける入出力レベル差に対する入力レベル特性
【図８】第２の実施の形態のフローチャート
【図９】テープタイプに対する特性の傾きを示すテーブル４
【図１０】第３の実施の形態のフローチャート
【符号の簡単な説明】
１・・・　入力端子
２・・・　インプットボリューム
３・・・　録音アンプ
４・・・　録音ヘッド
５・・・　テープ
６・・・　バイアス発振器
７・・・　再生ヘッド
８・・・　再生アンプ
９・・・　出力端子
１０・・　ＣＰＵ
１１・・　タイプ検知手段
１２・・　録音キャリブレーションボリューム
１３・・　テスト信号発振器
１４・・　レベル検出回路
１５・・　メモリ

【図４】

テーブル１

テープタイプ	初期値
クロム	－４．０ｄＢＶ
メタル	－４．０ｄＢＶ

【図９】

【図５】

テーブル２

テープタイプ	バイアス	補正量
クロム	ＯＶＥＲ	＋０．８ｄＢ
	ＲＥＦ	０．０ｄＢ
	ＵＮＤＥＲ	－０．７ｄＢ
メタル	ＯＶＥＲ	０．０ｄＢ
	ＲＥＦ	０．０ｄＢ
	ＵＮＤＥＲ	－０．４ｄＢ

【図６】

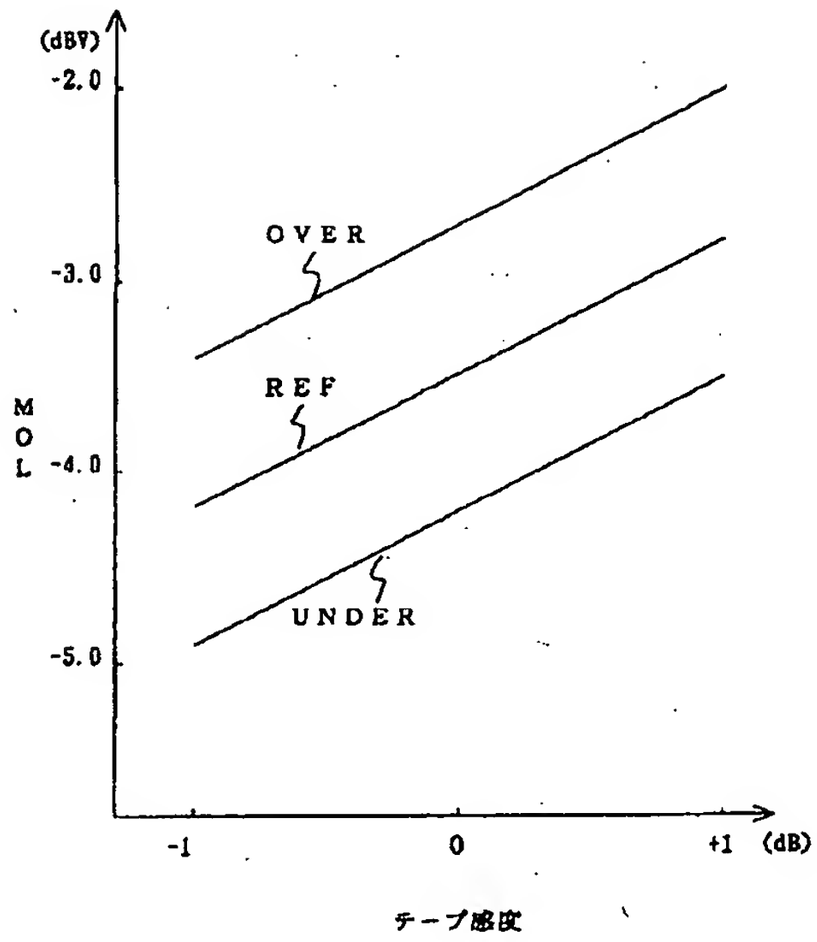
テーブル３

テープタイプ	特性の傾き
クロム	０．７
メタル	０．２

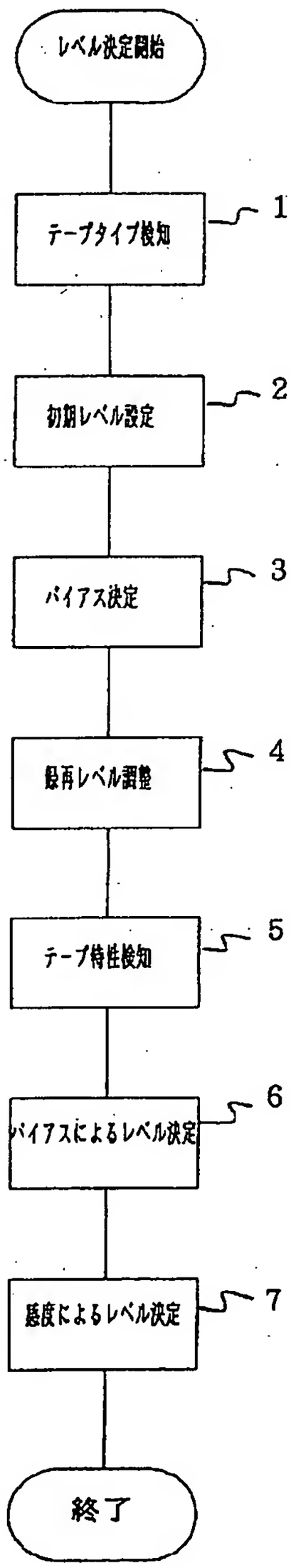
テーブル４

テープタイプ	特性の傾き
ノーマル	－１．２
クロム	－１．６

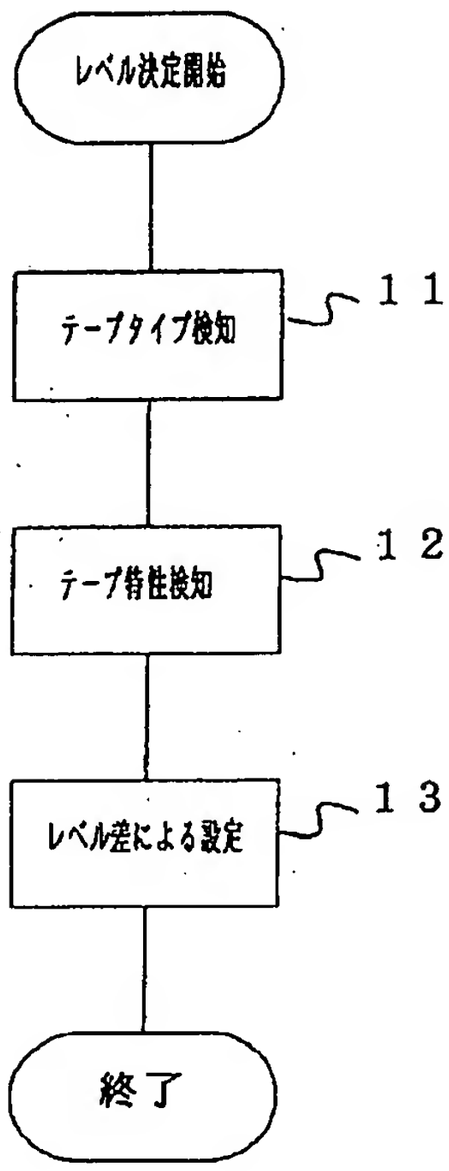
【図１】


(dBV)
-2.0
-3.0
-4.0
-5.0
MOL
OVER
REF
UNDER
-1
0
+1
(dB)
テープ感度

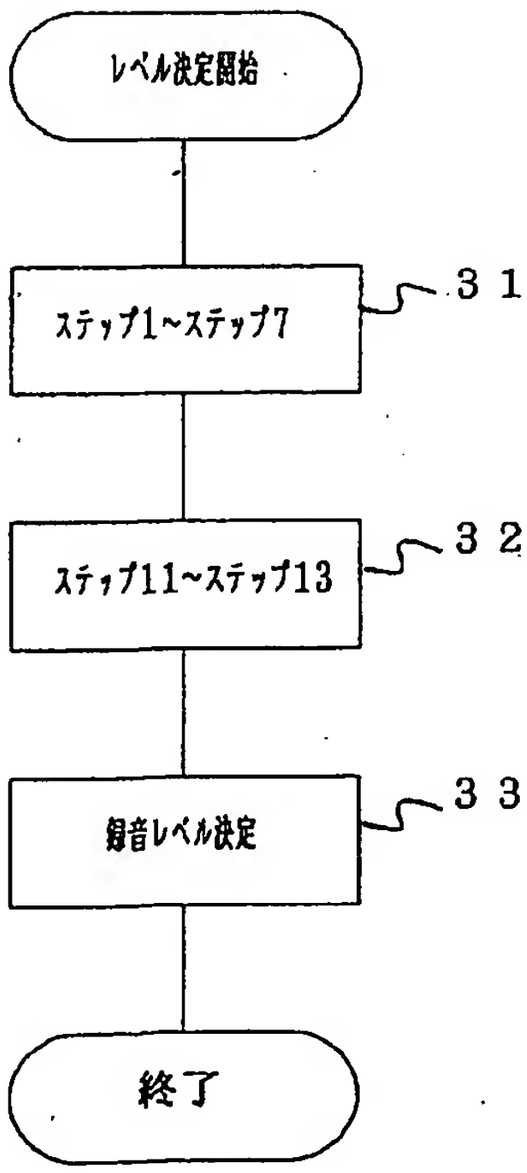
【図３】


レベル決定開始
テープタイプ検知
1
初期レベル設定
2
バイアス決定
3
最再レベル調整
4
テープ特性検知
5
バイアスによるレベル決定
6
感度によるレベル決定
7
終了

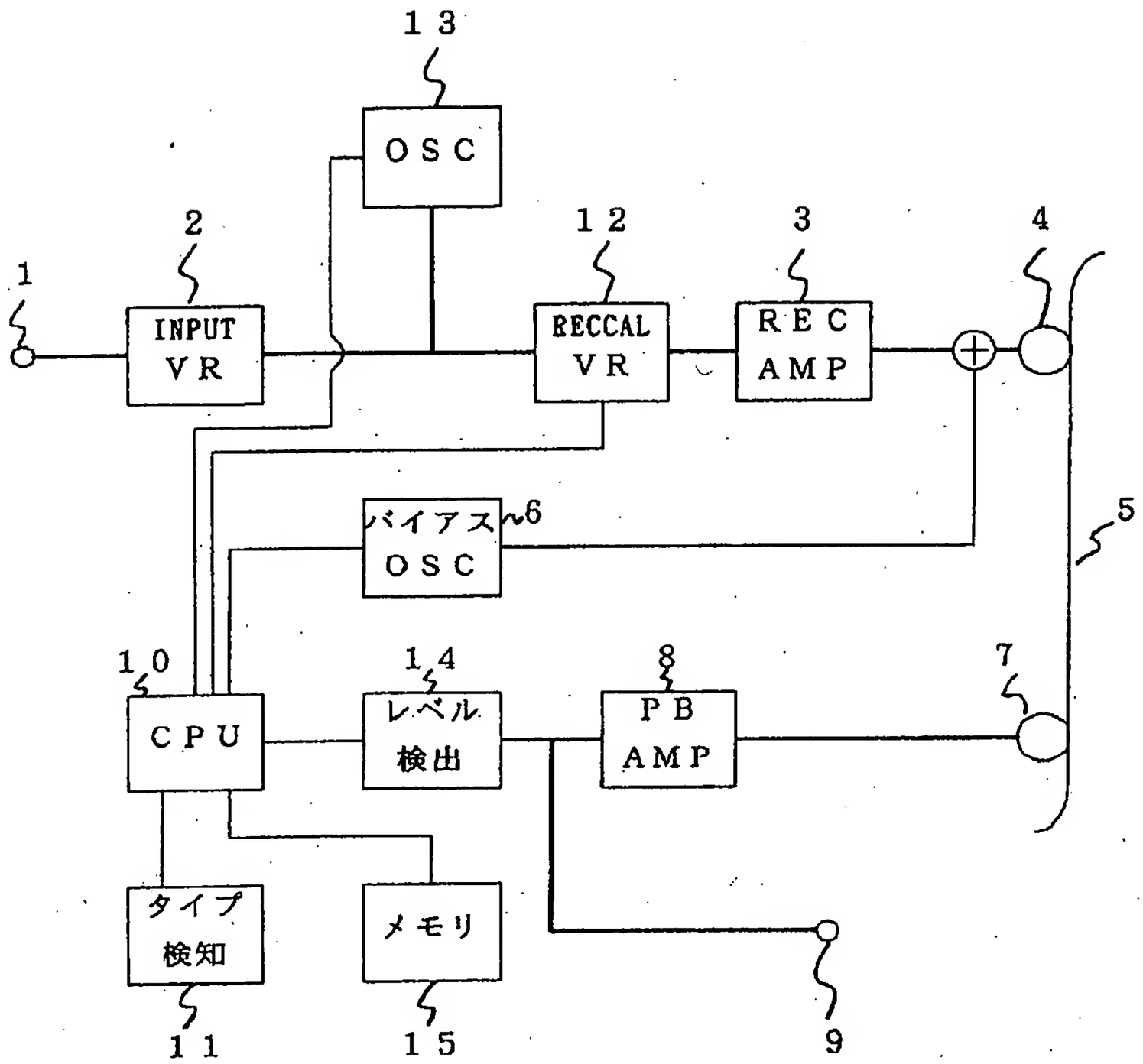
【図８】


レベル決定開始
テープタイプ検知
11
テープ特性検知
12
レベル差による設定
13
終了

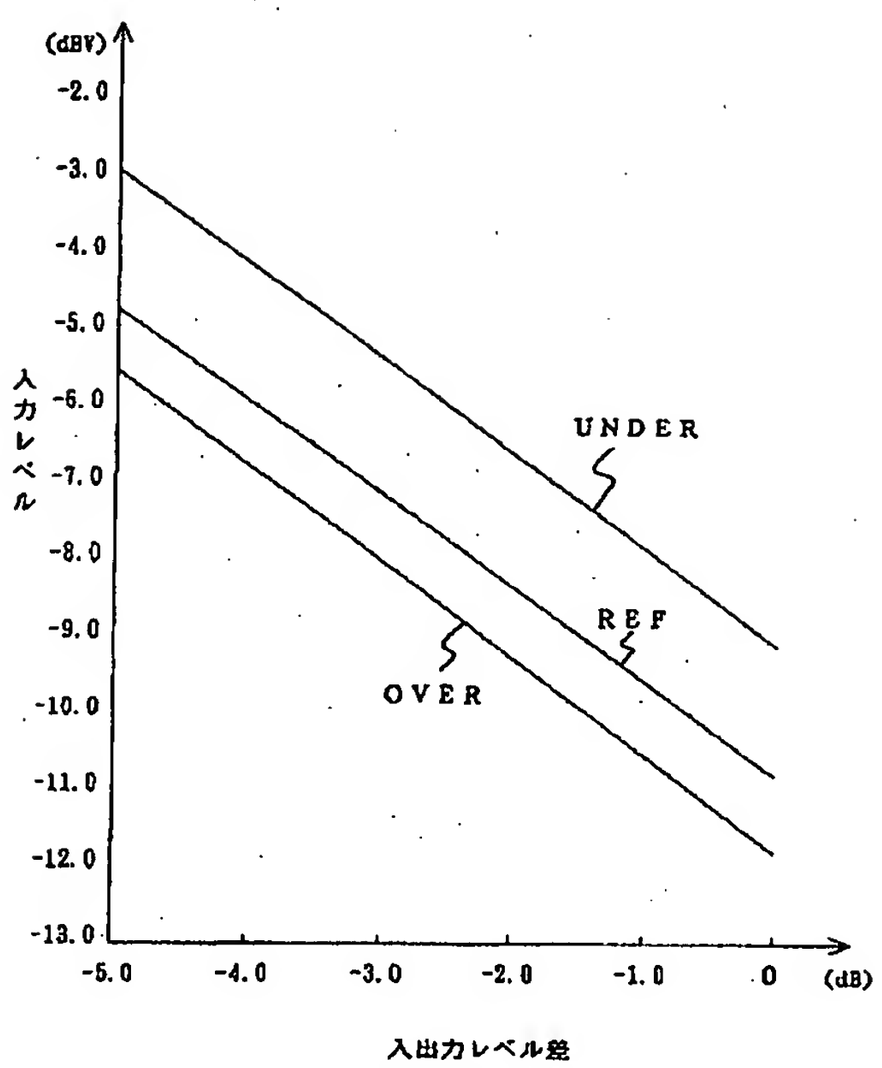
【図１０】


レベル決定開始
ステップ1~ステップ7
31
ステップ11~ステップ13
32
録音レベル決定
33
終了

【図2】


13
OSC
2
1
INPUT
VR
12
RECCAL
VR
3
REC
AMP
4
5
バイアス
OSC
6
10
CPU
14
レベル
検出
8
PB
AMP
7
タイプ
検知
メモリ
11
15
9

【図７】



【手続補正書】
【提出日】平成８年１２月１６日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】発明の詳細な説明
【補正方法】変更
【補正内容】
【発明の詳細な説明】
【０００１】
【産業上の利用分野】ピーク録音レベルを自動的に決定する記録装置に関する。
【０００２】
【従来の技術】テープタイプによってテープ感度などのテープ特性が異なることが知られており、使用するテープのテープタイプを検知して、そのテープタイプに応じて予め決められたピーク録音レベルを決定する装置があった。
【０００３】
【発明が解決しようとする課題】しかし、テープタイプが同一でも製造するメーカーまたはブランドが異なればテープ特性は異なり、テープタイプだけによるピーク録音レベルの設定では、最適なピーク録音レベルの設定は行えないものであった。そこで、本発明は使用する記録媒体の特性を測定し、その測定データに応じたピーク録音レベルを設定することで、良好な録音を達成することを目的とする。
【０００４】
【課題を解決するための手段】請求項１に記載の発明は、記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、テスト信号を発生するテスト信号発生手段と、記録媒体の記録感度に対するＭＯＬの関係を記憶している記憶手段と、前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段とを有し、前記記録感度測定手段の測定した記録媒体の記録感度及び前記記憶手段が記憶している関係に基づき前記記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づきピーク録音レベルを決定することを特徴とする。
【０００５】請求項２に記載の発明は、記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、テスト信号を発生するテスト信号発生手段と、記録媒体の記録感度に対するＭＯＬの関係を記憶している第１の記憶手段と、前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段と、前記記録媒体に適したバイアスである適正バイアスを決定するバイアス決定手段と、バイアスに対するＭＯＬの関係を記憶する第２の記憶手段とを有し、前記記録感度

測定手段の測定した記録媒体の記録感度、前記適正バイアス及び前記第１、第２の記憶手段が記憶している関係に基づき前記記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づきピーク録音レベルを決定することを特徴とする。

【０００６】請求項３に記載の発明は、記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、テスト信号を発生するテスト信号発生手段と、入出力レベル差に対する入力レベルの関係を予め記憶している記憶手段と、前記記録媒体に前記テスト信号を録音及び再生することにより入出力レベル差を測定するレベル差測定手段とを有し、前記レベル差測定手段の測定したレベル差及び前記記憶手段が記憶している関係に基づき、前記記録媒体の所定の入出力レベル差に対応する入力レベルを求め、この入力レベルに基づきピーク録音レベルを決定することを特徴とする。

【０００７】請求項４に記載の発明は、記録媒体に信号を録音する録音ヘッドと記録媒体から信号を再生する再生ヘッドを有する記録装置において、テスト信号を発生するテスト信号発生手段と、記録媒体の記録感度に対するＭＯＬの関係を予め記憶している第１の記憶手段と、入出力レベル差に対する入力レベルの関係を予め記憶している第２の記憶手段と、前記記録媒体に前記テスト信号を録音及び再生することにより記録媒体の記録感度を測定する記録感度測定手段と、前記記録媒体に前記テスト信号を録音及び再生することにより入出力レベル差を測定するレベル差測定手段と、録音レベルの大小を比較する比較手段とを有し、前記記録感度測定手段の測定した記録媒体の記録感度及び前記第１の記憶手段が記憶している関係に基づき記録媒体のＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差に基づき決定した第１の録音レベルと、前記レベル差測定手段の測定したレベル差及び前記第２の記憶手段が記憶している関係に基づき、使用する記録媒体の所定の入出力レベル差に対応する入力レベルを求め、この入力レベルに基づき決定した第２の録音レベルとを前記比較手段により比較し、第１、第２の録音レベルのうち低い値をピーク録音レベルとして決定することを特徴とする。

【０００８】

【実施例】以下、本発明の実施の形態の詳細を図面に基づいて説明する。

【０００９】［第１の実施の形態］一般的に聴感上許容される歪み量として３次高調波歪み３％が目安とされている。そこで、第１の実施の形態ではＭＯＬ（所定のバイアス電流で録音を行った場合に３次高調波歪みが３％となる出力レベル）又はＭＯＬの偏差に基き、ピーク録音レベル決定する。

【００１０】メーカーやブランドが異なる種々のクロムタイプテープを用い、所定のテスト信号で記録媒体の記録感度であるテープ感度（入力レベルに対する出力レベルの差）に対するＭＯＬの特性を測定した。この結果からテープ感度の良い、すなわち出力レベルの高いテープほどＭＯＬは高く、逆にテープ感度の悪いテープほどＭＯＬが低い傾向がわかる。このように、テープ感度とＭＯＬには相関関係がある。さらに、クロムタイプ以外の例えばノーマル、メタルタイプでもテープ感度に対するＭＯＬ特性は同様の特性を示す。

【００１１】本実施の形態ではこの相関関係を利用し、テープ感度からＭＯＬ又はＭＯＬの偏差を求め、このＭＯＬ又はＭＯＬの偏差からピーク録音レベルを決定する。また、本実施の形態ではテープ感度とＭＯＬの相関関係にはほぼ比例関係が見られるため、両者の相関関係を比例関係に近似して行う。その特性図（クロムタイプ）を図１に示す。ただし、テープタイプ毎によりテープ感度に対するＭＯＬ特性は異なるため、テープタイプに合わせた傾きなどを用いる必要がある。

【００１２】図２は第１の実施の形態の回路構成である。入力端子１から入力された信号は信号レベルを可変するインプットボリューム２およびテープ感度による信号レベルの調整を行う録音キャリブレーションボリューム１２を介して、録音アンプ３に供給され、この録音アンプ３で増幅された後に、録音ヘッド４によって記録媒体であるテープ５に録音される。また、テスト信号を発振するテスト信号発振器１３によるテスト信号も、同様に録音キャリブレーションボリューム１２及び録音アンプ３を介して録音される。テープ５に録音された信号は再生ヘッド７によって再生され、再生アンプ８によって増幅され、出力端子９に出力される。また、再生ヘッド７で再生され、再生アンプ８で増幅されたテープの出力レベルがレベル検出回路１４で検出され、中央演算処理装置ＣＰＵ１０に取り込まれる。ＣＰＵ１０はテスト信号発生器１３が発生するテスト信号の出力レベルと周波数、レベル検出回路１４により検出されたデータにより、適切なバイアスと録音キャリブレーションボリューム１２のレベルを決定する。さらに、ＣＰＵ１０はこの決定結果などをもとに、最適なピーク録音レベルを決定する。

【００１３】具体的な動作について、図２，図３を用いて説明する。タイプ検知手段１１により記録媒体であるテープのテープタイプが検知される（ステップ１）。

【００１４】ＣＰＵ１０は検知されたテープタイプとメモリ１５に記憶されているテーブル１（図４）に基づきピーク録音レベル初期値を仮設定する（ステップ２）。このピーク録音レベル初期値は、標準的な特性のテープ（テープ感度が０）のＭＯＬやＳ／Ｎなどの測定及び試聴により良好な録音ができるレベルに決定されている。例えば、クロムタイプでは－４．０ｄＢＶに仮設定される。なお、この値は基準（ＲＥＦ）のバイアスを用いて測定されているため、バイアス量が異なる時には補正を

行う必要がある。この補正は後述のステップ６で行われる。

【００１５】次に、テープの録音再生周波数特性がフラットになるようにバイアスの調整が行われる。バイアス調整はテスト信号発振器１３が４００Ｈｚ、－２３ｄＢＶ及び１０ＫＨｚ、－２３ｄＢＶのテスト信号を出力し、各々のテスト信号をバイアス発振器６によりバイアスをＯＶＥＲ（基準に比べ深い）、ＲＥＦ（基準）、ＵＮＤＥＲ（基準に比べ浅い）の３段階に変化させて録音する。そして、両テスト信号を再生ヘッド７で再生し、両テスト信号の出力レベルが最も近い値を示したときのバイアス量を最適バイアスとして選択し、バイアス発振器６はこのバイアス量に設定される。（ステップ３）。

【００１６】次に、テープに対しての入力レベルと出力レベルの差が０になるように録音感度の調整を行う。テスト信号発振器１３が４００Ｈｚ、－２３ｄＢＶのテスト信号を出力し、録音キャリブレーションボリューム１２のボリュームをスイープしながらテープ５に録音する。その後、テープ５からスイープ信号を再生する。この再生時に、ＣＰＵ１０はレベル検出回路１４により検出されるデータと、テスト信号発生器１３の出力レベルの比較を行い、差が０になるように録音キャリブレーションボリューム１２を設定する（ステップ４）。

【００１７】次に、テープ感度を測定する。ステップ４での録音キャリブレーションボリューム１２の調整前の初期ボリューム位置は、前述した標準的な特性のテープにおいて、入力レベルと出力レベルとの差が０となる位置であるため、ステップ４での録音キャリブレーションボリューム１２の調整量がテープ感度そのものなので、ステップ４の録音キャリブレーションボリューム１２の調整量をメモリ１５に記憶する。（ステップ５）。

【００１８】次に、ステップ３で選択されたバイアスによりピーク録音レベル設定を行う。ＣＰＵ１０はステップ３で決定されたバイアスをメモリ１５に記憶されるバイアスに対するピーク録音レベル補正値のテーブル２（図５）に基づき補正を行う。例えば、バイアスがＵＮＤＥＲに選択された時は、バイアスがＲＥＦの時に比べてＭＯＬは０．７ｄＢ低い値（バイアスＲＥＦに対するＭＯＬの偏差）を示すため、仮設定されている録音レベル初期値－４．０ｄＢＶから０．７ｄＢ下げた値である－４．７ｄＢＶに補正される（ステップ６）。

【００１９】次に、ステップ５で測定されたテープ感度からＭＯＬを補正し、ピーク録音レベル設定を行う。例えば、テープ感度が＋１．３ｄＢであると、テーブル３（図６）としてメモリ１５に保持されているテープ感度対ＭＯＬ特性の傾き０．７（クロムタイプ）を用いて、＋１．３×０．７＝０．９ｄＢ（テープ感度０に対するＭＯＬの偏差）と演算され、ＭＯＬは＋０．９ｄＢ高いことが分かる。そのため、ピーク録音レベルは－４．７ｄＢＶ＋０．９ｄＢ＝－３．８ｄＢＶと決定される（ステップ７）。

【００２０】また、第１の実施の形態ではテープ感度及び調整したバイアスからＭＯＬを求めたが、バイアスの調整を行わない固定バイアス記録装置ではテープ感度のみによりＭＯＬを求めても良い。また、第１の実施の形態では、テープ感度とＭＯＬの関係を比例関係（１次関数）によって近似して行ったが、テープ感度とＭＯＬの関係は複数次の関数などで近似を行ってもよい。

【００２１】さらに、第１の実施の形態ではメモリに記憶されている演算用の係数を用いた演算によりＭＯＬを求めたが、メモリに多数のテープ感度に対するＭＯＬの関係を示したテーブルを記憶しておき、このテーブルを用いてＭＯＬを求めても良い。なお、第１の実施の形態では基準のバイアス、テープ感度によるＭＯＬの偏差を求め、ピーク録音レベル初期値を補正してピーク録音レベルの決定を行ったが、測定したテープ感度、使用バイアス及びメモリ内のテーブルからＭＯＬを求め、そのＭＯＬから所定値だけレベルを上下させるなどして、ＭＯＬに基づきピーク録音レベルを決定しても良い。

【００２２】［第２の実施の形態］高い周波数信号の入出力特性によりピーク録音レベルの決定をする。所定の高い周波数信号例えば１０ＫＨｚの信号において、入力レベルに対する入出力レベル差の特性を測定すると、入力レベルが高くなるにつれて入出力レベル差は大きくなる傾向が見られる。なお、ここで言う入出力レベル差とは、テープに記録した信号のレベルである入力レベルから、その信号をテープから再生した信号レベルである出力レベルを引いたレベル差である。このように、入力レベルと入出力レベル差には相関関係がある。また、高い周波数信号ではこの入出力レベル差が顕著にあらわれるため、高い周波数信号で入出力レベル差が０であれば、それより低い周波数での入出力レベル差は０である。そして、この入出力レベル差が０であれば、原信号に忠実な録音が可能であり、良好な録音であると言える。

【００２３】そのため、この入力レベルに対する入出力レベル差の特性を元に、測定した入出力レベル差から入出力レベル差０であるときの入力レベルを求める。さらに音楽信号の周波数特性を考慮することによりピーク録音レベルが決定できる。また、本実施の形態では入力レベルと入出力レベル差の相関関係にはほぼ比例関係が見られるため、両者の相関関係を比例関係に近似する。クロムタイプにおける、その特性図を図７に示す。また、同一テープタイプであればバイアスが変わってもほぼ同一の傾きを示す。ただし、図示しないがクロムタイプ以外のテープタイプでもほぼ比例関係は示すがクロムタイプと傾きは異なる。

【００２４】具体的な動作を図２，図８を用いて説明する。タイプ検知手段１１により記録されるテープのテープタイプが検知される（ステップ１１）。例えば、クロムタイプが検出されたとする。

【００２５】テスト信号発振器１３により１０ＫＨｚ、－６ｄＢＶのテスト信号を出力するようにＣＰＵ１０が制御する。テスト信号はテープ５に録音及び再生され、レベル検出回路１４の検出した再生レベルによりＣＰＵ１０がテスト信号の入出力レベル差を検出する（ステップ１２）。

【００２６】次に、ＣＰＵ１０が検出した入出力レベル差から、入出力レベル差が０となる入力レベルを演算する。テープタイプに応じた入力レベルに対する入出力レベル差特性の傾きがメモリ１５内のテーブル４（図９）に記憶されている。ここでは、ステップ１１でテープタイプがクロムタイプと検出されているので、傾き－１．６が入力レベルの演算に用いられる。例えば、ステップ１２で検出された入出力レベル差が－３ｄＢであったとすると、入出力レベル差を０にするためにはこの差を３ｄＢだけ正方向に縮める必要がある。そこで、３ｄＢにクロムタイプの特性の傾き－１．６を乗ずると、３ｄＢ×－１．６＝－４．８ｄＢとなり、入出力レベル差を０にするためには、入力レベルをテスト信号のレベル（－６ｄＢＶ）より、４．８ｄＢだけ低いレベルにする必要がある。つまり、入力レベルが－６ｄＢＶ－４．８ｄＢ＝－１０．８ｄＢＶ以下であれば、入力レベル差は０になっていると考えられる。ところが、音楽信号の周波数分析を行うと最も高域成分を含んでいる音楽信号においても、テスト信号として用いた１０ＫＨｚのレベルは全帯域のレベルに比べて７．５ｄＢ以上低くなっている。このために、ピーク録音レベルとしては－１０．８ｄＢＶ＋７．５ｄＢ＝－３．３ｄＢＶと決定される（ステップ１３）。

【００２７】また、第２の実施の形態ではメモリに記憶されている演算用の係数を用いた演算により入出力レベル差０における入力レベルを求めたが、メモリに多数の入出力レベル差に対する入力レベルの関係を示したテーブルを記憶しておき、このテーブルを用いて入出力レベル差が０であるときの入力レベルを求めても良い。なお、第２の実施の形態では、入力レベルと入出力レベル差の関係を比例関係（１次関数）によって近似して行ったが、テープ感度とＭＯＬの関係は複数次の関数などで近似を行ってもよい。

【００２８】［第３の実施の形態］本実施の形態は、第１の実施の形態に示した感度によるピーク録音レベル決定と第２の実施の形態に示した高周波信号の周波数特性によるピーク録音レベル決定の両者を用いて、さらに精度の高いピーク録音レベルの決定を行う。

【００２９】図１０を用いて、具体的な動作を説明する。まず、第１の実施の形態のステップ１からステップ７を行う。ステップ７で決定された第１ピーク録音レベルをメモリ１５に保持する（ステップ３１）。第１ピーク録音レベルはここで、あげられている例では－３．８ｄＢＶである。

【００３０】次に、第２の実施の形態のステップ１１からステップ１３を行い、第２ピーク録音レベルを決定し、メモリ１５に記憶する（ステップ３２）。第２ピーク録音レベルはここで、あげられている例では－３．３ｄＢＶである。

【００３１】次に、ＣＰＵ１０は第１、第２ピーク録音レベル両者を比較し、低い値を選択する。ここでは第１ピーク録音レベルである－３．８ｄＢＶが選択される。両者の低い方を選択する理由は、第１ピーク録音レベルより大きなレベルで記録すると、歪みが大きくなってしまい聴感上問題となる、また第２ピーク録音レベルより大きな値で記録すると、入力レベルに対して出力レベルが得られずに、こもった録音となるためである。そして、ここで選択された値を最適ピーク録音レベルとして決定する（ステップ３３）。

【００３２】また、ステップ３２で行われるテープタイプの検知動作は省略し、ステップ３１のテープタイプの検知結果を用いても良い。

【００３３】さらに、テスト信号によりテープ特性を検出するステップ４とステップ１２は続けて行っても良い。

【００３４】

【発明の効果】このように、テスト信号の記録及び再生を行い、テープ感度などの記録媒体の特性からピーク記録レベルを決定するため、使用する記録媒体の能力を十分に利用したピーク録音レベルが決定できる。

フロントページの続き

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